DOE/OR/21548-128
CONTRACT NO. DE-AC05-86OR21548

WASTE ANALYSIS PLAN

Weldon Spring Site Remedial Action Project
Weldon Spring, Missouri

AUGUST 1992

REV. 4

U.S. Department of Energy
Oak Ridge Operations Office
Weldon Spring Site Remedial Action Project

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DOE/OR/21548-128

Weldon Spring Site Remedial Action Project

Waste Analysis Plan

August 1992

Revision 4

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Prepared for

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A K-1435 Waste Acceptance Plan

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1 INTRODUCTION

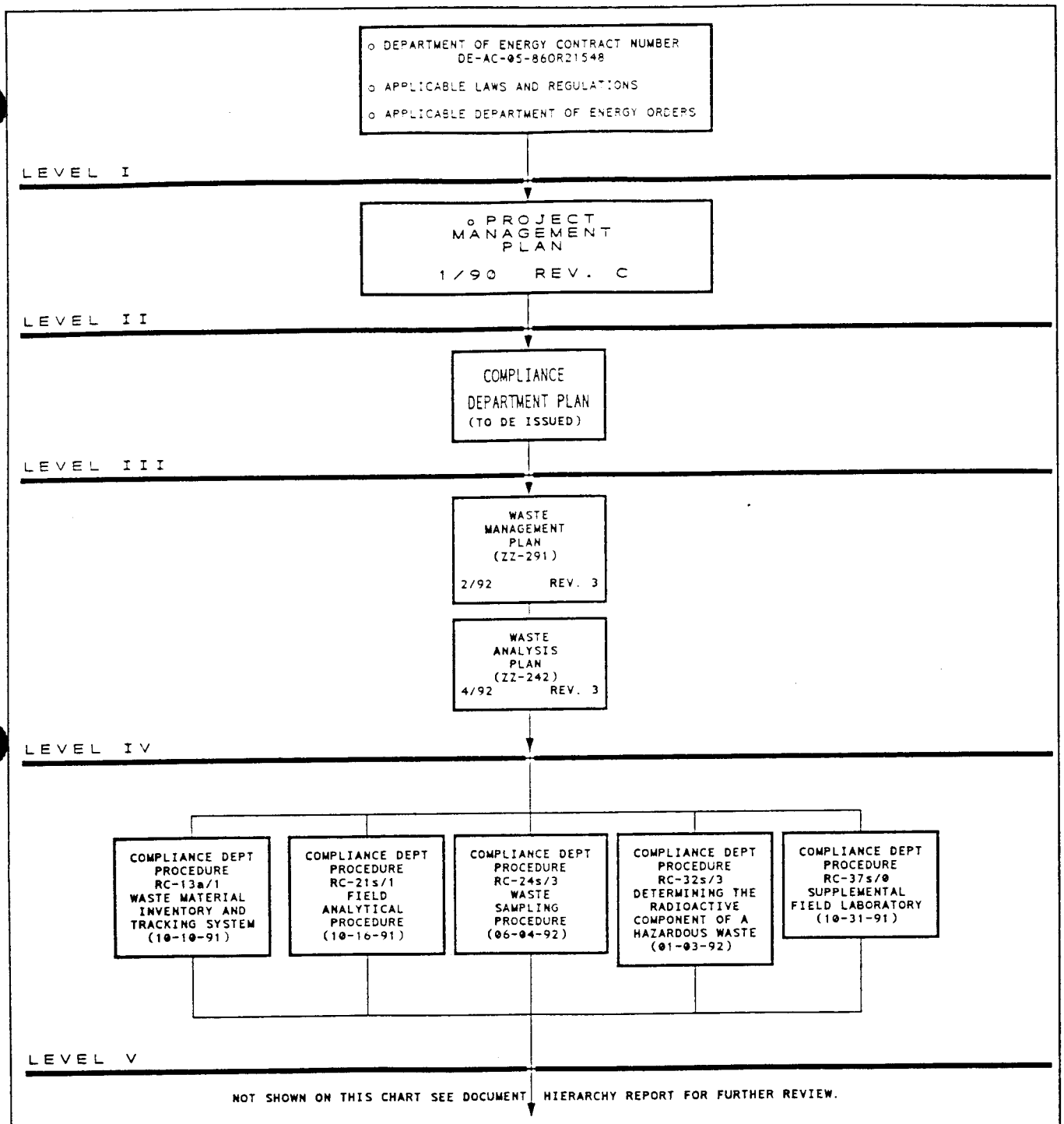
This *Waste Analysis Plan* has been designed to address chemical and radiochemical characterization requirements for management of wastes encountered at the Weldon Spring site, (WSS) Weldon Spring, Missouri. At a minimum, this plan will provide the means to obtain information necessary to classify, treat, store, or dispose of these wastes. The *Waste Analysis Plan*, which is designated as level IV in the Compliance Department document hierarchy (Figure 1-1), supports the Weldon Spring Site Remedial Action Project (WSSRAP) *Waste Management Plan* (MKF and JEG 1992a) and provides guidance to Waste Management personnel in the preparation of detailed sampling and analysis plans.

1.1 Background

Under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the site is required to comply with the applicable substantive requirements of the Resource Conservation and Recovery Act (RCRA) regulations. The requirements for long-term storage of hazardous waste are found in Title 40 of the Code of Federal Regulations, Part 264, which pertains to operation of Department of Energy Technical Service Division hazardous waste facilities. These regulations require detailed chemical and physical analysis of a representative sample of each waste.

The key elements of this *Waste Analysis Plan*, which are consistent with the General Facility Standards contained in 40 CFR 264.13(b)(1-3), specify:

- The appropriate sampling method for obtaining a representative sample of the waste for analysis.
- The parameters for which each waste will be analyzed, and the rationale for the selection of those parameters.
- The appropriate test methods required for these parameters.



WASTE ANALYSIS PLAN
DOCUMENT HIERARCHY

FIGURE 1-1

REPORT NO.: DOE/OR/21548-128		EXHIBIT NO.: A/PI/134/0892	
ORIGINATOR: LDP	DRAWN BY: GLN	DATE: 8/92	

1.2 Purpose

The purpose of this *Waste Analysis Plan* is to accomplish the following three objectives:

1. Characterization for compatibility and proper container selection prior to bulking and recontainerization of unknowns.

2. Identification of those wastes that are subjected to the storage and disposal requirements of RCRA and/or the Toxic Substances Control Act.

3. Recharacterization of site generated wastes to detect any changes in the concentrations of chemical constituents, the appearance of new constituents, or variations in physical properties.

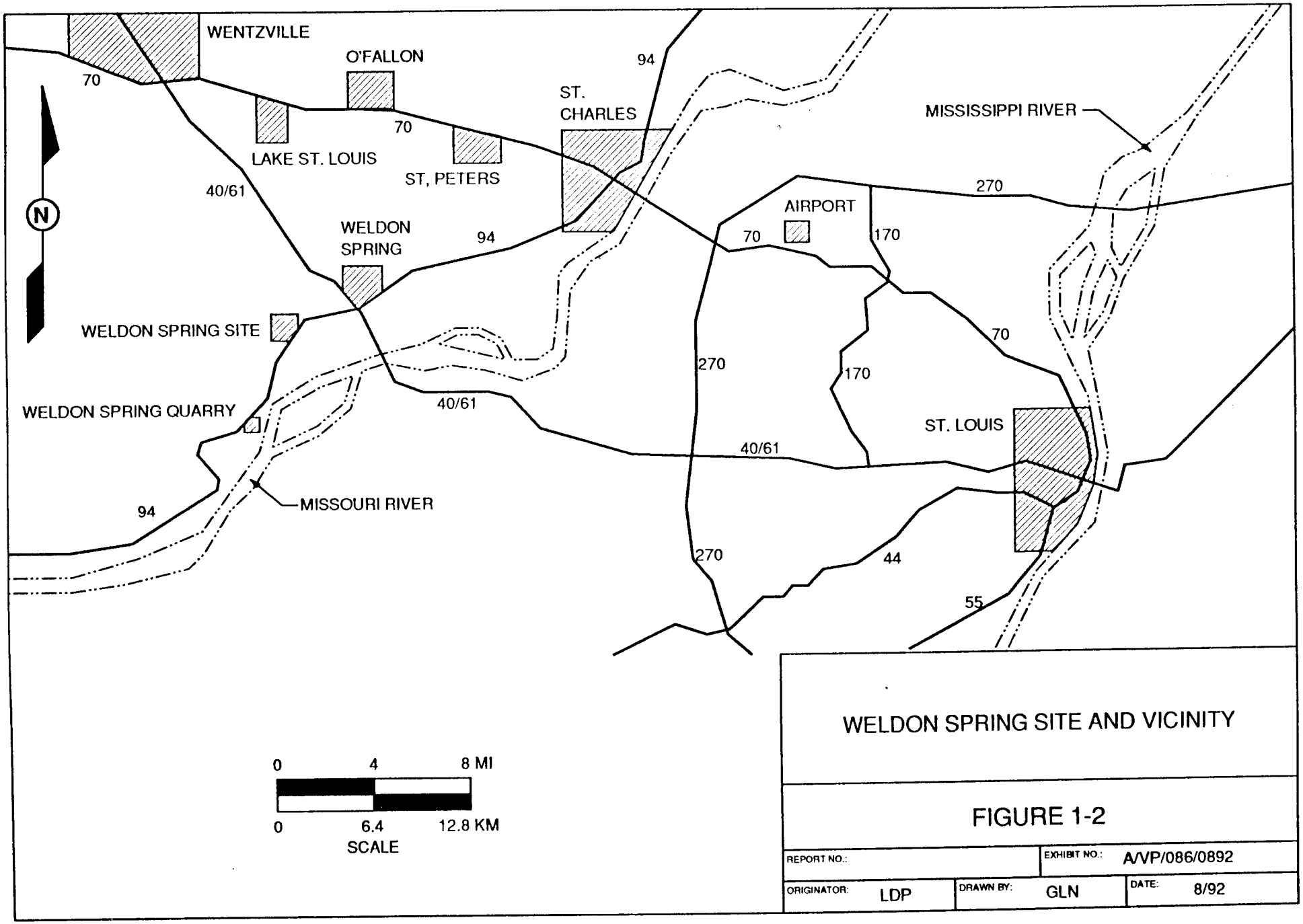
1.3 Scope

The plan is tailored to the requirements of the Weldon Spring Site Remedial Action Project in its effort to manage and ultimately dispose of hazardous and mixed wastes at the Weldon Spring site. Since the WSS is an inactive facility and a broad array of chemical wastes have been left at this site, this plan is generic in nature. It considers chemical and radiological analyses required for mixed waste characterization, interim storage, and disposal.

1.4 Site Description and Location

The Weldon Spring site (Figure 1-2) is located approximately 30 mi west of St. Louis in western St. Charles County, Missouri. St. Charles, the largest city in St. Charles County, is located approximately 15 mi northeast of the site. The site is bordered by large tracts of land owned by the Federal Government and the State of Missouri.

The WSS is divided into two distinct areas; one includes the raffinate pits and the chemical plant (Figure 1-3), which encompass 51 acres and 166 acres respectively, and the other is the quarry (Figure 1-4) which is located about 4 mi south-southwest of the raffinate pit/chemical plant area. These areas are located on Missouri Highway 94 southwest of the junction of U.S. Highway 40 (also known as Interstate 64 or U.S. Highway 61) and Missouri Highway 94.



WELDON SPRING SITE AND VICINITY

FIGURE 1-2

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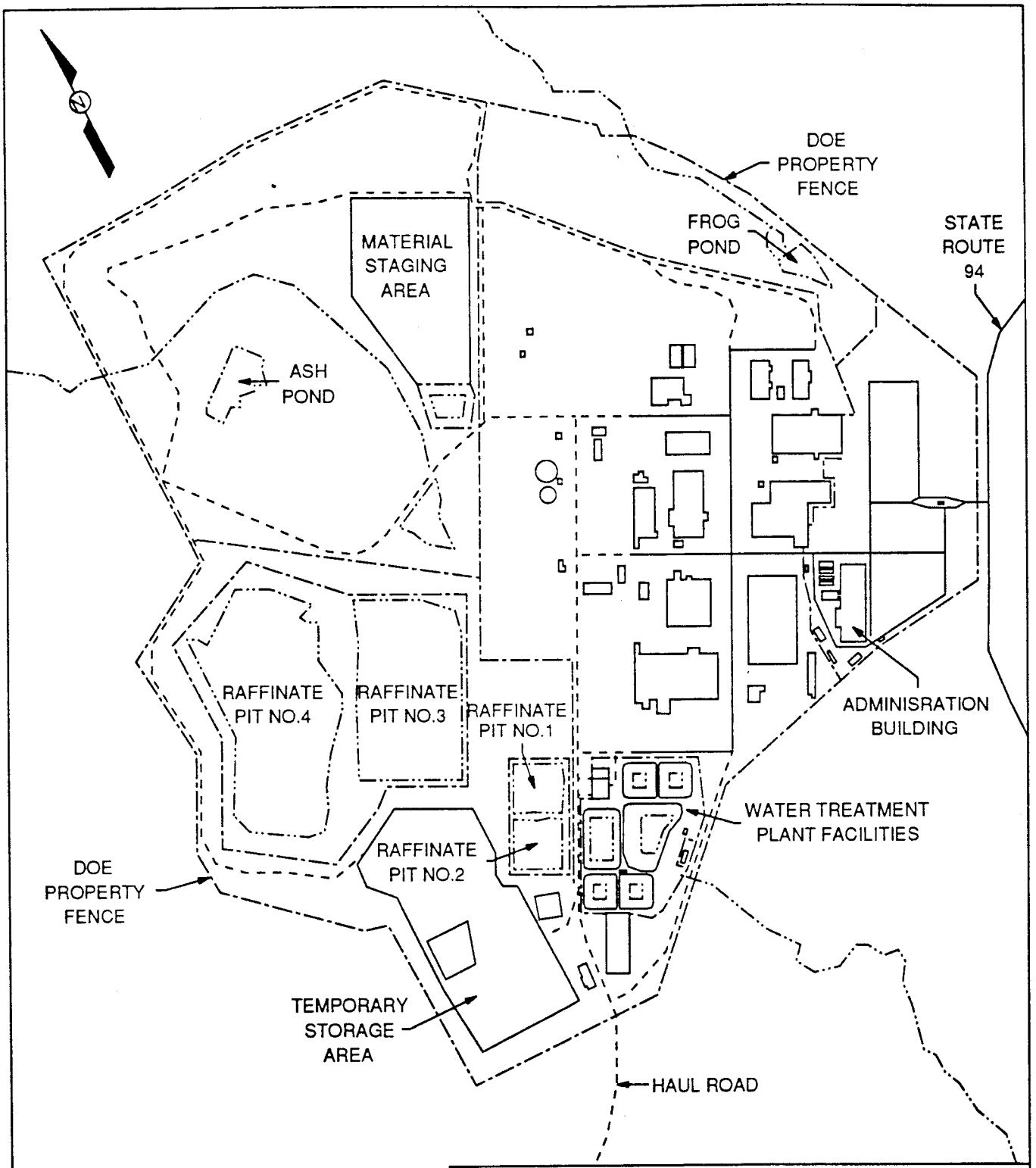


LAYOUT OF THE CHEMICAL PLANT AND RAFFINATE PIT AREA

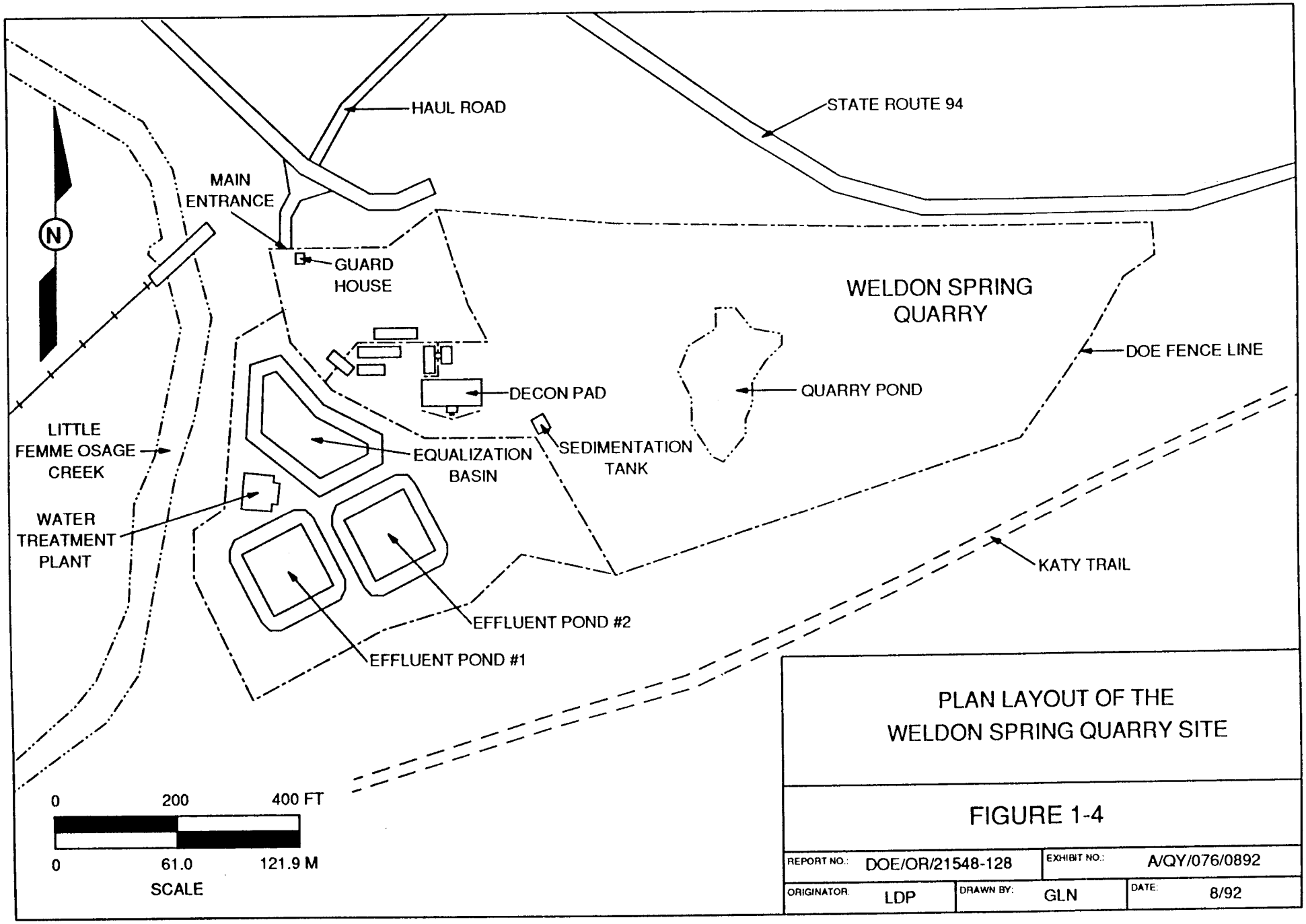
0 500 1000 FT

0 152.4 304.8 M

SCALE

FIGURE 1-3

REPORT NO.: DOE/OR/21548-128		EXHIBIT NO.: A/CP/082/0892	
ORIGINATOR: LDP	DRAWN BY: GLN	DATE: 8/92	



PLAN LAYOUT OF THE WELDON SPRING QUARRY SITE

FIGURE 1-4

REPORT NO.: DOE/OR/21548-128		EXHIBIT NO.: A/QY/076/0892	
ORIGINATOR: LDP	DRAWN BY: GLN	DATE: 8/92	

The raffinate pit area contains four surface impoundments (raffinate pits) which contain wastes primarily from uranium and thorium processing and cover approximately 26 acres. The chemical plant consists of 13 major buildings, approximately 30 support structures, and the Ash Pond and Frog Pond areas. Ash Pond and Frog Pond are the two surface water bodies within the chemical plant area. Frog Pond is a surface impoundment near the northwest edge of the site.

The quarry is located in limestone and covers about 9 acres. The deepest part of the quarry is filled with water covering about 0.5 acres and is the only surface water body within this controlled area. A major source of potable groundwater in this area is the county well field located about 1 mi southeast of the quarry in the Missouri River alluvium.

1.5 Site History

From 1941 to 1944, the U.S. Department of the Army operated the Weldon Spring ordnance works (WSOW), constructed on the land that is now the WSS, for production of trinitrotoluene (TNT) and dinitrotoluene (DNT). The Army used the quarry for disposal of rubble contaminated with TNT. In the mid 1950s, 205 acres of the ordnance works property was transferred to the U.S. Atomic Energy Commission (AEC). This is now the raffinate pits and chemical plant area. An additional 15 acres was later transferred to the AEC for expansion of waste storage capacity. From 1957 to 1966, the AEC operated a uranium-processing facility at the Weldon Spring Uranium Feed Materials Plant, which subsequently became the Weldon Spring Chemical Plant (WSCP). Ore concentrates and some scrap metal were processed at the plant. Products that included uranium metal were shipped to other sites. Thorium-containing materials were processed on an intermittent basis. Radioactive raffinates from the processing were placed in four on-site pits. Other radioactive wastes were disposed of in the quarry.

After closure by the AEC, the chemical plant was reacquired by the Army in 1967. The Army partially decontaminated several buildings, dismantled some of the equipment, and began converting the facilities to produce herbicides. In 1969, prior to becoming operational, the herbicide project was canceled prior to bulk quantities of production chemicals being brought on site. As successor to the AEC, the U.S. Department of Energy (DOE) assumed responsibility for the raffinate pits. In 1984, the Army repaired several of the buildings at the chemical plant, decontaminated some of the floors, walls, and ceilings, and isolated some contaminated equipment.

In May 1985, the DOE designated the control and decontamination of the WSS as a Major Project (this project has since been designated as a Major System Acquisition). In October 1985, custody of the chemical plant was transferred to the DOE. A Project Management Contractor (PMC) for the Weldon Spring Site Remedial Action Project (WSSRAP) was selected in February 1986, and a DOE project office was established on the site in July 1986. The Project Management Contractor, MK-Ferguson Company, assumed control of the WSS on October 1, 1986.

On October 15, 1985, the U.S. Environmental Protection Agency (EPA) proposed to include the quarry on the National Priorities List (NPL). This listing occurred on July 30, 1987. On June 24, 1988, the EPA proposed to expand this designation to include the raffinate pits and chemical plant area. On March 30, 1989, these areas were also included in the listing and resulted in a single designation as the WSS.

1.6 Overview of Site Contamination

The WSS is contaminated with radioactive materials, nitroaromatics, heavy metals, asbestos, and various organic compounds. Contamination has been detected in various media groups including surface water, groundwater, soil, sludge, structures, and equipment. Asbestos has been found throughout the site buildings in the form of transite siding and insulation. Most of the asbestos is radiologically contaminated. Contamination in the vicinity of the WSS is located mainly along ditches, drainageways, and roads; some of the nearby ponds and lakes also contain elevated concentrations of certain contaminates.

Raffinate Pits 1, 2, and 3 contain raffinate sludge and slag resulting from the refining of uranium ore concentrates and the recycling of scrap metal at the chemical plant. In addition to this type of slag and sludge, Pit 4 contains wastes from the processing of thorium-containing materials and drums and rubble from the partial decontamination of the chemical plant. The pits contain approximately 168,200 m^3 (220,000 cy) of wastes. Thorium-230 is the predominant radionuclide in the pit wastes.

The chemical plant consisted of 43 buildings and miscellaneous structures. The actual processing of radioactive materials occurred in only a small number of these buildings. However, contamination has been confirmed in most of the non-process buildings and external areas as well. The spread of contamination most likely occurred as a result of (1) routine plant

operations (e.g., tracking of contaminants from process areas and temporary relocation of contaminated equipment for repair), (2) processing support activities (e.g., waste handling), and (3) surficial deposition of airborne particulates. Some contamination also may have occurred subsequent to plant closure as a result of relocation of some contaminated equipment from process buildings into non-process buildings during earlier cleanup activities, and from transport of contaminated material by environmental factors (e.g., wind) and local biota (e.g., wasps).

Numerous smaller containers of miscellaneous wastes were left in various locations about the chemical plant. These containers were collected, consolidated (where appropriate), and containerized and placed into storage.

The quarry was used intermittently for disposal of chemically and radioactively contaminated materials from the early 1940s to 1968. The radioactively contaminated materials are those associated with uranium and thorium processing activities previously carried out at the chemical plant and at other sites in the St. Louis area. The chemical contaminants include polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), and nitroaromatics. There are approximately 72,600 m^3 (95,000 cy) of contaminated wastes in the quarry. These wastes are in the form of rubble, soil, equipment, structural steel, and sludges. In addition to uranium, elevated concentrations of several metals including arsenic, copper, lead, and nickel have been detected.

Table 1-1 illustrates the wide variety of chemicals that has been used at the WSS.

1.7 Facility Description

Building 434 is currently used for storage of drummed waste at the WSS. This building, which was formerly used as a storage structure, was cleaned and refitted to RCRA and Toxic Substances Control Act (TSCA) standards. The defective concrete was removed and the floor was cleaned with a High Efficiency Particulate Air (HEPA) vacuum and washed with a tri-sodium phosphate solution. It was then etched with a 15% hydrochloric acid solution which was subsequently neutralized with a weak ammonium hydroxide solution and flushed with water.

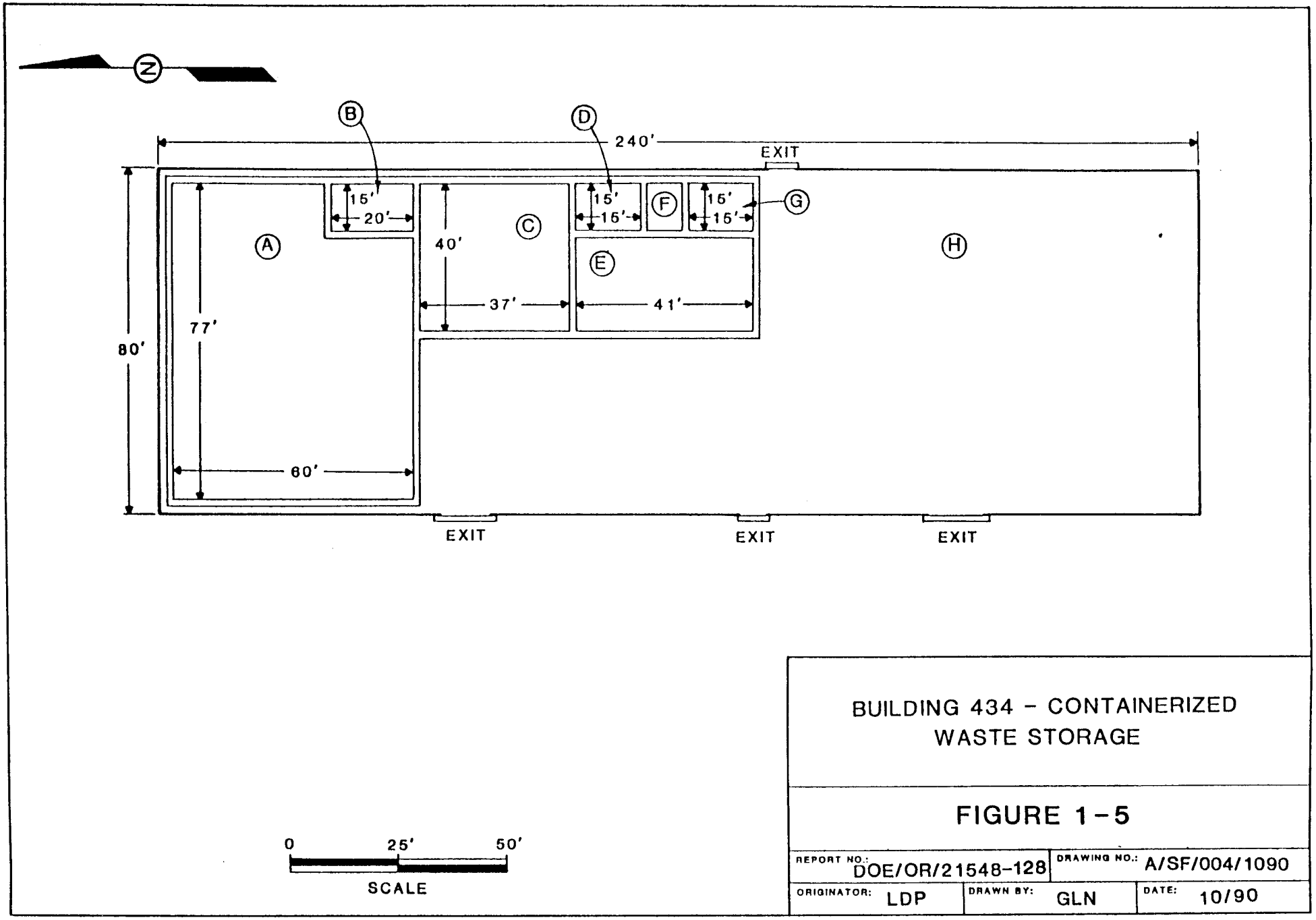
All joints and cracks were sealed utilizing a polyurethane sealant. An epoxy coating with slip resistant granules was applied to the floor after the installation of curbing for secondary containment for liquids (see Figure 1-5).

TABLE 1-1 Chemicals Used at Former Explosives Production Facility and Uranium Feed Materials Processing Plant

TNT, DNT Production (chemicals used at site)	
Ammonia	Oleum (sulfuric acid)
Caustic soda	Toluene
Fuel oil	Nitric Acid
	Sellite (sodium sulfite)

Uranium Processing	
Nitric acid	Sodium zeolite
Sodium hydroxide	Sulfite
Sulfuric acid	Helium
Sodium carbonate	Hydraulic oil
Phosphate	Uranium metal
UNH (uranium amine)	Laboratory chemicals
UO_3 (uranyl oxide)	Perchloric acid
Uranium ore concentrate	Grease
Lime	Chlorine
Ether	Chromium phosphates
Ethylene glycol	Acid (misc.)
Tributyl phosphate	Benzene
Ferric nitrate	Corrosive resistant coating
Paint and catalysts	Epoxy paint and catalysts
Anhydrous hydrogen	Unspecified flammable
Ammonia	materials
Green salt	Hot die lube
(uranium tetrafluoride	Linseed oil (boiled)
Hydrofluoric acid	Lubriplate
Hydrogen gas	Melcolene
Nitrogen gas	Metalube
Orange oxide	Methylene glycol
(uranium oxide orange)	Methylisobutyl ketone
Propane	Motor oil
Caustic liquid	Paint
Magnesium	Paint solvents
Graphite sheets	Phenoline thinner
Diesel fuel	Polyclad
Fuel oil	Polyurethane paint
Gasoline	Rustbound primer
Hydrogen zeolite	Tar
Refrigeration brine	

Source: (MKF and JEG 1988; reproduced from JEG 1989).



BUILDING 434 - CONTAINERIZED WASTE STORAGE

FIGURE 1-5

REPORT NO.: DOE/OR/21548-128	DRAWING NO.: A/SF/004/1090	
ORIGINATOR: LDP	DRAWN BY: GLN	DATE: 10/90

Lighting is provided by lights suspended from the roof support structure with service provided by 240 volt panelboards located inside the structure.

An acrylic/aliphatic urethane resin coating designed for seamless encapsulation was applied to the roof of the structure to prevent leakage. Three secondary containment areas were created within the building by constructing 6 in. x 6 in. concrete berms. Four smaller containment areas were constructed within these areas by securing 4 in. x 0.25 in. angle iron to the floor. These containment areas are designed to provide secondary containment in accordance with both RCRA and TSCA requirements.

1.8 Overview of Waste Characterization

For the purpose of characterization, there are seven general categories of waste that require different laboratory sample preparation and analytical procedures present at the Weldon Spring site. The manner in which the wastes are to be grouped is dependent on chemical composition and the waste disposal or treatment technology to be utilized.

Aqueous liquid wastes which are considered inorganic can be acids, bases, solutions containing toxic metals and/or organics, or solutions containing reactive cyanide or sulfides. These wastes are candidates for chemical treatment or incineration.

Non-aqueous liquid (NAL) wastes, which include chlorinated and non-chlorinated solvents, fuels, and organophosphorus liquids such as tributyl phosphate, are candidates for incineration. The majority of the NALs are radioactively contaminated to the extent that commercial incineration scenarios are not feasible. Thus, the analytical and physical characterization requirements specified in the *Waste Acceptance Plan for the K-1435 Toxic Substance Control Act (TSCA) Resource Conservation and Recovery Act (RCRA) Incinerator* (DOE 1986) should be met for organic liquid wastes. Table 1 of the K-1435 *Waste Acceptance Plan* has been included as Appendix A to this *Waste Analysis Plan.*

Oils and paints, although they are NALs, are treated as a separate category for the purposes of waste analysis. Untreated wastes classified as oils and paints are not viable land disposal candidates due to the amount of free liquids, toxic metals such as chromium and lead, and land-disposal-restricted organics (LDR) in these wastes which precludes land disposal. Although the amount of heavy metals typically present in paint-related materials make this type

of waste a marginal incineration candidate, oils and paints destined for off-site disposal are to be analyzed according to the requirements for incineration.

As a generic category, non-soil solids (NSS) include both inorganic and organic materials. Inorganic NSS materials may be inorganic salts or metals. It is possible that these wastes are characteristically hazardous due to elevated levels of toxic characteristic leaching procedure (TCLP) metals, cyanide or sulfide levels in excess of regulatory guidelines or water reactivity.

Organic NSS materials include organic chemicals in crystalline or powdered form (as well as wood and plastics). It is possible that some of these materials are "listed substances" or contain "listed substances". The presence or absence of any such "listed substance" must be determined to allow proper management of these wastes. These wastes may also be considered hazardous if they contain in excess of the regulatory limits of any TCLP constituent listed in 40 CFR 261.24.

Soils and solids include materials such as soil, sand, roofing material, concrete, and dust collected in vacuum cleaner bags. During site activities, a variety of chemically contaminated soils will be encountered which will require characterization to ensure proper management. Demolition activities will also result in a variety of wastes that will require characterization.

Site generated wastes are those wastes generated at the Weldon Spring site through on-site laboratory support activities, vehicle maintenance, personal protective equipment usage, and monitoring activities. In many cases, the chemical make-up of the waste will be known or can be approximated through knowledge of the generation process and will allow these materials to be placed in one of the above mentioned categories.

The final general category of wastes is of unknown liquids and solids. These are unknowns which are primarily small quantities of laboratory reagents and commercial products, or those materials contained in sumps or tanks which have not been characterized or consolidated. The consolidation of unknowns will not occur. Only after proper identification and subsequent reclassification into one of the other classes will materials be consolidated.

The field analytical requirements of each category are shown in Table 1-2 and the detailed laboratory analytical requirements are shown in Table 1-3. Each analysis must be

TABLE 1-2 Field Waste Analysis for Generic Waste Types

Parameter	Aqueous Liquids	Non-Aqueous Liquids	Oils & Paints	Inorganic Non-Soil Solids	Organic Non-Soil Solids	Soils & Solids	Unknowns[a]
Visual inspection	X	X	X	X	X	X	X
Surface radiological survey	X	X	X	X	X	X	X
pH	X			X		b	b
Redox	X	X		X	X	b	X
Solution-reactivity	X	X	X	X	X	b	X
Flame test	X	X	X	X	X	b	X
Sodium fusion		X			X	b	c
Ferrox		X			X	b	c
Hydrocarbon functionality		X			X	b	c
Oxygen functional group		X			X	b	c
Nitrogen functional group		X			X	b	c
Sulfur functional group		X			X	b	c
PCB screen			X			b	c
Flashpoint		X	X			b	c
Field compatibility	X	X	X	X	X	b	X
Fingerprint screening						b	
Inorganic functional group	X			X		b	c

a Unknowns are materials, which based on visual inspection and surface radiological scan, cannot be classified into any other class until sufficient field analyses are completed to allow reclassification.

b These tests will be performed based on the judgement of the Waste Management Group. Manager or his designee on a case-by-case basis.

c These tests will be performed once it has been determined that the waste can be classified in another generic class that is amenable to the indicated analysis.

TABLE 1-3 Laboratory Waste Analysis for Generic Waste Types

Parameter	Aqueous Liquids	Non-Aqueous Liquids	Oils & Paints	Inorganic Non-Soil Solids	Organic Non-Soil Solids	Soils & Solids	Unknowns[a]
Suspended solids	X		X				a
Total metals	X	X	X	X		X	a
Volatile organics		X	X			X	a
Semi-volatile organics		X	X			X	a
Moisture content		X	X	X	X	X	a
Specific gravity	X	X	X				a
Ash content	X	X	X	X	X	X	a
Flash point		X	X				a
Corrositivity	X	X	X			X	a
Heating value		X	X		X	X	a
Reactivity	X	X	X	X	X	X	a
Total organic halides	X					X	a
Total organic carbons	X		X			X	a
Paint filter test		X	X	X	X	X	a
Radiological characterization	X	X	X	X	X	X	a
Viscosity		X	X			X	a
PCBs		X	X		X	X	a
Dioxins and furans		X			X		a
Oil and grease	X					X	a

TABLE 1-3 Laboratory Waste Analysis for Generic Waste Types (Continued)

Parameter	Aqueous Liquids	Non-Aqueous Liquids	Oils & Paints	Inorganic Non-Soil Solids	Organic Non-Soil Solids	Soils & Solids	Unknowns[a]
Suspended solids	X		X				a
Sulfur	X	X					a
Chlorine	X	X	X	X	X		a
Phosphorus	X	X	X	X	X		a
Bromine	X	X	X	X	X		a
Fluoride	X	X	X	X	X	X	a
TCLP metals	X	X	X	X	X	X	a
TCLP pesticides	X	X			X	X	a
TCLP herbicides	X	X			X	X	a
TCLP volatiles (ZHE)	X	X	X	X	X	X	a
TCLP semi-volatiles	X	X	X	X	X	X	a
Asbestos				X	X	X	a
Polyaromatic hydrocarbons	X				X	X	a
Nitroaromatics	X				X	X	a

a Analysis to be performed after consolidation into one of the remaining groups

tailored to the specific waste; however, the choice of analytical parameters can generally be limited to those indicated in the table. The appropriate method for each parameter is shown in Table 1-4.

Wastes that can be categorized or determined to be nonhazardous based on original container labels do not require analysis for chemical characterization.

TABLE 1-4 Method Reference

Laboratory Parameter	Method Reference
Suspended solids	EPA 1601
Total metals	SW 6010, SW 7XXX[a]
TCL volatiles	EPA CLP
Volatile organics	SW 8240
BTEX	SW 8020
Semi-volatile organics	SW 8270
Moisture contents	ASTM D1533 or ASTM D2216
Specific gravity	ASTM 3142 or ASTM C854
Ash content	ATM D482 or ASTM D3174
Flash point	SW 1010
Heating value (BTU)	ASTM D3286 or ASTM D240 or SW 5050
Corrositivity	SW 1110 or SW 9045
Elemental analysis/anions	
1. Sulfur	ASTM D129 or ASTM D3286/EPA 3000
2. Phosphorus	EPA 36528
3. Fluorine	ASTM D3761 or ASTM D3286/EPA 3000
4. Chlorine	SW 9251, ASTM D2361 or ASTM D3286/EPA 3000
5. Sulfate	SW 9036/EPA 3000
6. Nitrate	SW 9200/EPA 3000
Reactivity (cyanide and sulfide)	SW 7332 and SW 7341
TCLP	Extraction SW 1311
1. Metals	Digestion: SW 3010 Analysis: SW 6010
2. Pesticides	Extraction: SW 3510 Analysis SW 8080
3. Herbicides	Extraction: EPA 615 Analysis EPA 615
4. Volatile organics	Analysis 8240
5. Semi-volatile organics	Extraction 3510 Analysis 8270
Total organic halides (TOX)	SW 9020
Total organic carbon (TOC)	SW 9060
Paint filter test	SW 9095

TABLE 1-4 Method Reference (Continued)

Laboratory Parameter	Method Reference
Suspended solids	EPA 1601
Radiological characterization	
1. Total uranium	EPA 520/5-84-006[b] Method 00-05
2. Th-230	EPA 520/5-84-006[b] Method 00-05
3. Th-232	EPA 520/5-84-006[b] Method 00-05
4. Gross alpha and beta	SW 9310
Viscosity	ASTM D445
PCBs	SW 8080
Oil and grease/TPH	EPA 4131 SW 9073
Dioxins and furans	SW 8280
Asbestos	EPA 600/M4-82-020
Polyaromatic hydrocarbons	SW 8310
Nitroaromatics	SW 8330

a 7000 Series Methods (Atomic Absorption Methods)
b Eastern Envrionmental Radiation Facility Radiochemistry Procedure Manual, August 1984

2 QUALITY ASSURANCE AND QUALITY CONTROL

Weldon Spring site (WSS) detailed laboratory data must be legally defensible and valid. This requirement must be understood, planned, and provided for to ensure that adequate quality control is maintained. The project quality assurance (QA) organization is detailed in procedure QAPP-1 and the *Environmental Quality Assurance Program Plan* (EQAPP) (MKF and JEG 1991c).

2.1 Data Quality Objectives

Due to the wide variety of waste types, information sought, and end use of the data from waste analysis, no single set of data quality objectives (DQOs) can be established. DQOs are developed during the planning stages for each waste management sampling activity.

Since the Weldon Spring Chemical Plant is not an active facility, and because of documentation regarding the generation process of these wastes and waste management practices common to industry at the time of plant shutdown, many wastes at the WSS require detailed characterization to determine their regulatory status. Additionally, due to the extent of known radioactive contamination present on site, all wastes are characterized to determine if such contamination is present.

There are basically five reasons for collecting samples at the Weldon Spring Site Remedial Action Project (WSSRAP). Samples may be collected solely for the purpose of subjecting them to qualitative field analyses. These analyses are designed to provide gross chemical characterization information; determine the extent and appropriateness of detailed laboratory analyses; and aid in determining shipping classification and packaging, marking, and labeling requirements for transportation purposes.

Semiquantitative field analyses are performed on various samples collected at the WSSRAP. These analyses determine crude concentration levels to support the decision making process for various projects such as liner leak detection, well tracer studies, and water treatment plant equipment settings.

Quantitative or detailed laboratory analyses are performed to provide precise and accurate data regarding the characteristics of given wastes to determine proper regulatory classification, appropriateness of various treatment or disposal options, and to satisfy the analytical requirements of any treatment, storage, or disposal facility (TSDF) that may accept wastes from the WSS. Additionally, prior to releasing any waste material from the radioactive materials management areas (RMMA) of the WSS, wastes must be sampled and subjected to detailed radiological analyses as detailed in procedure RC-32. This procedure is used to verify that waste materials meet the requirements of DOE 5400.5, *Radiation Protection of the Public and Environment*, as well as the WSS off-site release policy.

Lastly, waste materials proposed for consolidation must be sampled and verified to be compatible by two waste management engineers (WME). This action is necessary to minimize the potential for adverse reactions and unnecessary chemical or radiological exposures.

Accuracy and precision must be determined and assessed through the use of quality control samples including distilled water blanks, trip blanks, equipment blanks, field duplicates, matrix spikes, and matrix spike duplicates. Table 2-1 documents the frequency that these samples must be collected and the DQOs routinely applied. It must be noted that the DQOs are intended for guidance only. DQOs specific to a sampling activity may vary slightly and should be documented in the sampling and analyses plan for that activity.

Distilled water blanks are used to monitor the purity of the distilled used to prepare preserving reagents, trip blanks, and equipment blanks. These samples will be collected quarterly from the distilled water reservoir.

Trip blanks document volatile organic contamination attributable to shipping and field handling procedures. Trip blanks must be collected prior to entering the field to perform any sampling activity. Trip blanks are collected by filling the vial directly from the distilled water reservoir, transporting the vials unopened to the sampling site, and then shipping unopened to the laboratory. A trip blank is required each day for each sampling activity where samples are collected for volatile organic analysis.

Equipment blanks are useful in documenting adequate decontamination of reusable sampling equipment. They are collected after completion of decontamination, and prior to sampling, by collecting a sample of the media used to rinse the sampling equipment.

TABLE 2-1 QA Sample Frequency and Data Quality Objectives for Waste Analysis

	Distilled Water Blank		Trip Blank		Equipment Blank		Matrix Spike & Matrix Spike Duplicate		Field Duplicate	
Analyte	Frequency	Criteria	Frequency	Criteria	Frequency	Criteria	Frequency	Criteria	Frequency	Criteria
Volatile organics	1/QTR	---	1/Event	a	1/Event	a	1/20 or 1/batch	b	1/20 or 1/batch	b
Semi-volatile organics	NA	---	NA	---	1/Event	a	1/20 or 1/batch	b	1/20 or 1/batch	b
Pesticides/PCBs; herbicides	NA	---	NA	---	1/Event	a	1/20 or 1/batch	b	1/20 or 1/batch	b
Nitroaromatics	NA	---	NA	---	1/Event	a	1/20 or 1/batch	b	1/20 or 1/batch	b
Polyaromatic hydrocarbons	NA	---	NA	---	1/Event	a	1/20 or 1/batch	b	1/20 or 1/batch	b
Dioxins and furans	NA	---	NA	---	1/Event	a	1/20 or 1/batch	b	1/20 or 1/batch	b
Oil and grease/TPH	NA	---	NA	---	1/Event	a	1/20 or 1/batch	b	1/20 or 1/batch	<20% RPD
Total organic carbon	1/QTR	<1ppm	NA	---	1/Event	a	1/20 or 1/batch	b	1/20 or 1/batch	<25% RPD
Total organic halides	1/QTR	All CMPD<DL	NA	---	1/Event	a	1/20 or 1/batch	b	1/20 or 1/batch	<25% RPD
Metals	1/QTR	All CMPD<DL	NA	---	1/Event	a	1/20 or 1/batch	b	1/20 or 1/batch	b
Cl, SO_4, F, NO_3, PO_4	1/QTR	All CMPD<DL	NA	---	1/Event	a	1/20 or 1/batch	b	1/20 or 1/batch	b
Total U, Th-228, 230, 232	1/QTR	All CMPD<DL	NA	---	1/Event	a	1/20 or 1/batch	b	1/20 or 1/batch	b
Heating value (BTU)	NA	---	NA	---	1/Event	a	NA	---	1/20 or 1/batch	<20% RPD
Flash point	NA	---	NA	---	1/Event	a	NA	---	1/20 or 1/batch	<20% RPD
Ash content	NA	---	NA	---	1/Event	a	NA	---	1/20 or 1/batch	<20% RPD
Suspended solids	1/QTR	<DL	NA	---	1/Event	a	NA	---	1/20 or 1/batch	<20% RPD
Specific gravity/viscosity	NA	---	NA	---	1/Event	a	NA	---	1/20 or 1/batch	<20% RPD
Swipes	NA	---	NA	---	1/Event	a	NA	---	1/20 or 1/batch	<50% RPD

a No higher than the highest of the following: All compounds <DL; All compounds <0.05 Regulatory Threshold; All compounds <0.05 Sample Concentration

b Evaluated on a case-by-case basis.

Field duplicates are independent samples that are collected as close as possible to the same point in space and time. They are two separate samples taken from the same source, stored in separate containers, and analyzed independently. These samples are useful in documenting the precision of the sampling process.

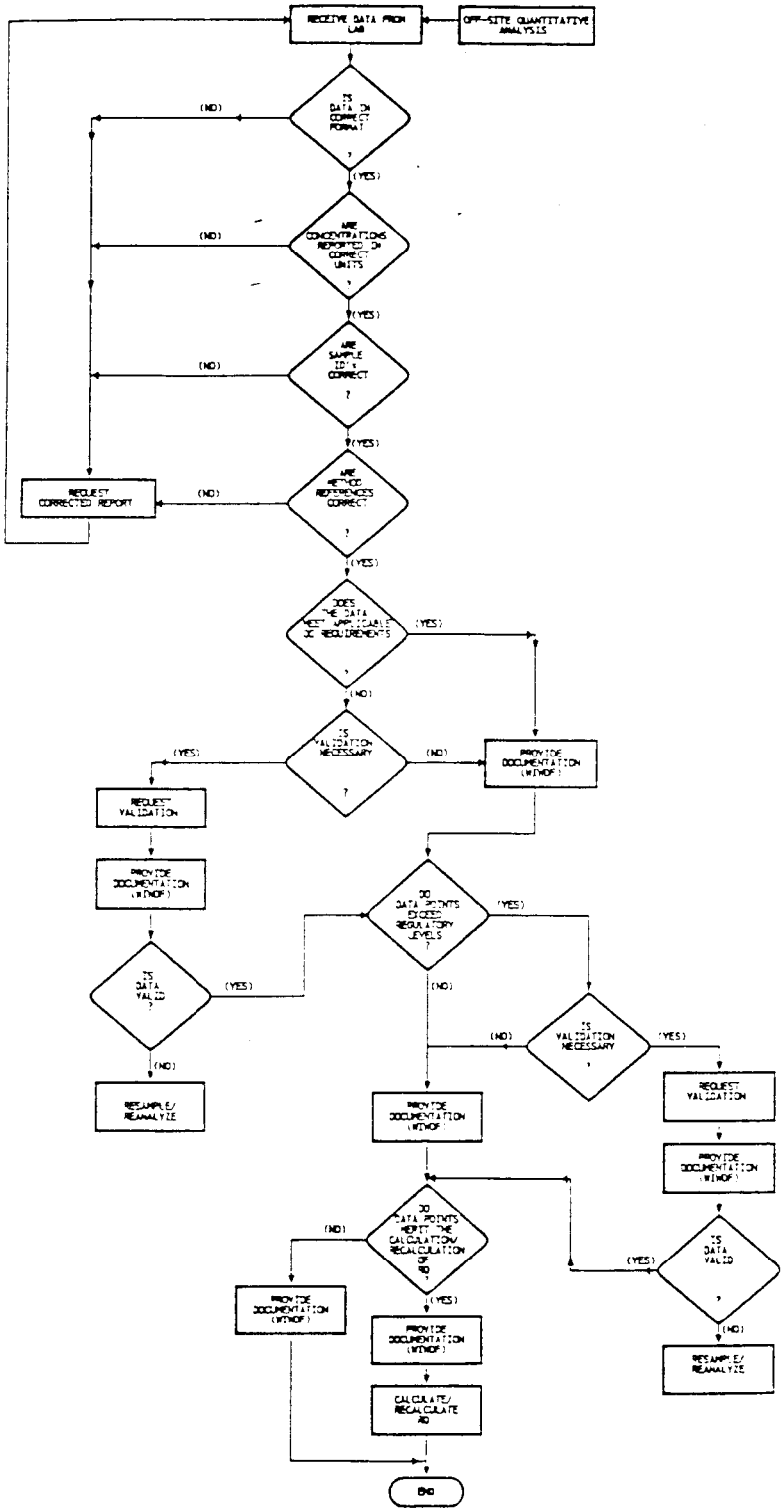
Matrix spikes and matrix spike duplicates are intralaboratory splits of a single sample that receive identical spike concentrations of the target analyte and are used to document the precision and bias of a method in a given sample matrix.

2.2 Data Verification

All detailed laboratory data must be reviewed and verified upon receipt by procedure ES&H 4.9.1 to ensure that documentation and data are reported in compliance with established reporting requirements and standard operating procedures (SOPs), and to ensure all requested analyses are performed. Only analytical methods specified in Table 1-4, or any attachments to this *Waste Analysis Plan*, are to be used for detailed laboratory analyses. Substitutions or departures from these methods must not be allowed without written Project QA or Waste Management Department consent prior to the analysis.

Chain-of-custody procedures as detailed in procedure ES&H 4.1.2, including Laboratory Work Authorization Form completion, must be maintained for all samples submitted for detailed analysis. Waste Management Field Sampling Data Forms, as required by procedure RC-24s, must be maintained during all sampling operations to document sampling methods, equipment, and observations.

Analytical data in the form of a formal hard copy report must be reviewed as indicated in Figure 2-1 by technical Waste Management Group (WMG) personnel familiar with the investigation and/or the analytical protocols requested. This review determines the general acceptability of the data and the regulatory status of the material. Review of the data for each material must be documented on a Waste Inventory Tracking System (WITS) Data Sheet in accordance with procedure RC-13a.



WASTE MANAGEMENT

DATA REVIEW PROCESS

FIGURE 2-1

REPORT NO.:		EXHIBIT NO.:	A/PI/123/0792
ORIGINATOR: LDP	DRAWN BY: SRS	DATE: 7/92	

2.3 Data Validation

Data validation documents the quality and usefulness of the data and the documentation developed during sample analysis. Laboratory records of analytical data and quality related field data are reviewed to assess laboratory performance as compared to quality control criteria, data quality requirements, and procedural requirements.

Approximately 5% of the data points from waste samples submitted to the contract laboratories will be validated. These data points will be selected randomly by the laboratory coordinator. An additional 5% of the data points will be selected for validation by technical personnel familiar with the particular waste analysis program after the data review portion of the verification process is complete.

2.4 Waste Analysis Records and Documentation

All waste analysis QA records must be maintained on file by the QA Department in accordance with procedure QAPP-9 for the duration of the project or until otherwise directed by the U.S. Department of Energy (DOE). At a minimum, these records will be retained for 10 yr after the completion of remedial actions as required by the *Comprehensive Environmental Response, Compensation and Liability Act* (CERCLA).

Waste analysis QA records must include the following:

- Waste Management Field Sampling Data Forms (RC-24s)
- Chain-of-Custody Forms (ES&H 4.1.2)
- Laboratory Authorization Request Forms (ES&H 4.1.2)
- Field Analysis Data Sheets (FADs) (RC-21s)
- Supplemental Analysis Report (SAR) (RC-37s)
- Bench Scale Compatibility Determination (RC-26s)
- Drum Inventories (RC-26s)
- Waste Inventory Tracking System (WITS) Data Sheet (RC-13a)
- Analytical data reports received from detailed laboratory analyses
- Certification of Nonradioactive Waste (RC-32s)

Duplicates of all the above are maintained by the WMG in the waste analysis files. For containerized wastes, all data and forms pertaining to a particular container are placed into a file unique to the WITS number assigned to that container. All other data are filed by sampling event or activity.

Additionally, all WMG field personnel are required to maintain field logs in accordance with procedure RC-38s. These logs should contain additional information such as discussions and observations that can further support or detail the decision making process logic. When complete, these logs are transferred to the QA department for maintenance as project QA records.

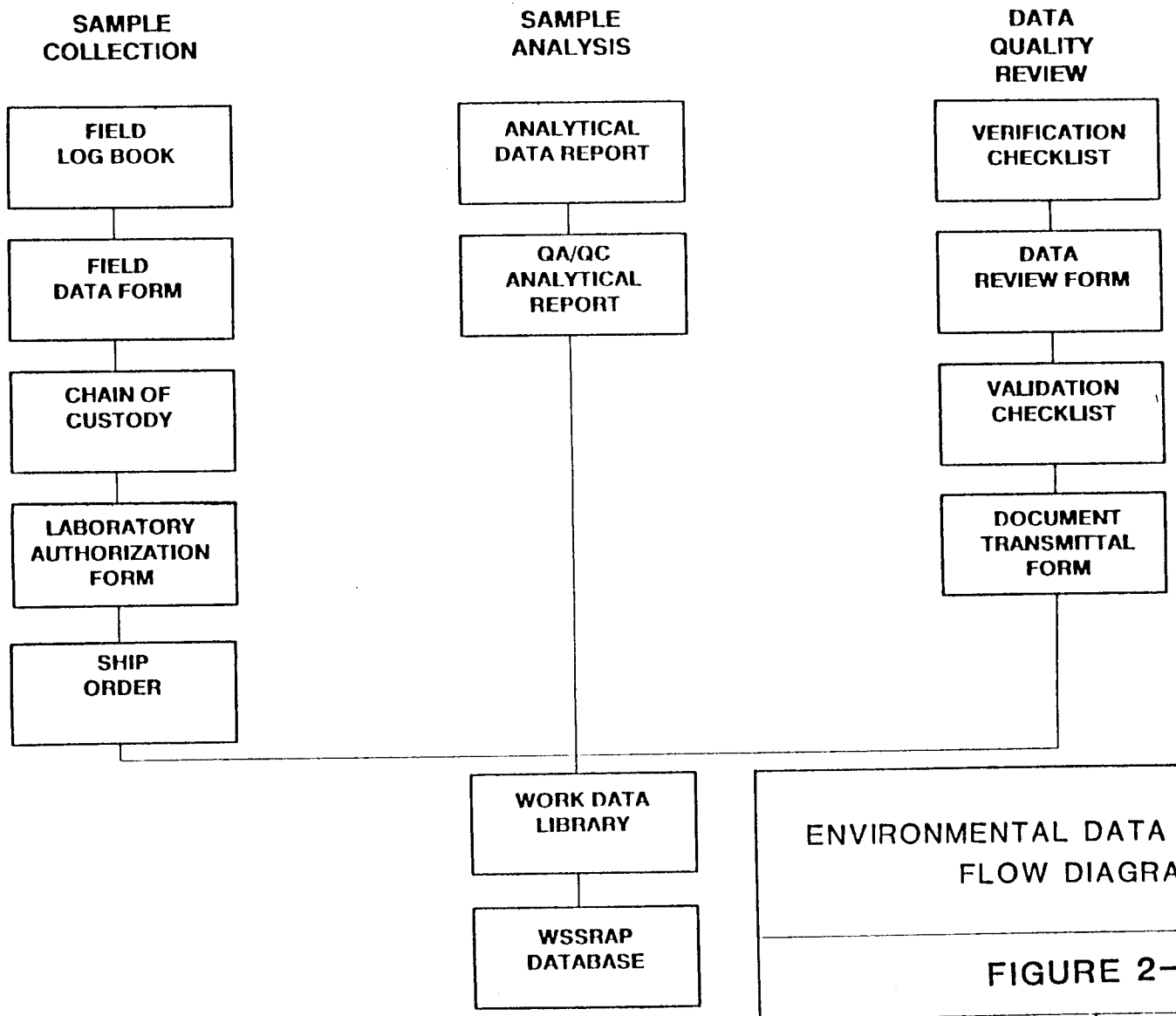
All waste analysis data from detailed laboratory analyses are placed in the generic universal report utility (GURU) data base. Data in the GURU database can be extracted and sorted based on sample identification number, parameter, or any other field definition. Users are allowed to view or copy records, but records cannot be modified or deleted in the GURU system.

A WITS database maintained by the WMG is designed to identify the locations and various types of materials during all phases of the project including final disposition. The WITS data form is used to document original inventory along with all additions and/or changes to the WITS based on field observations, field analysis or consolidation, and data from detailed laboratory analysis. The database includes regulatory class information, U.S. Environmental Protection Agency (EPA) or Missouri Department of Natural Resources (MDNR) waste identification numbers, container type and weight, as well as waste form descriptions.

The waste analysis data audit trail is detailed in Figure 2-2. It should be noted that only project QA-approved laboratories are used for detailed laboratory analysis. Technical specifications for analytical support, which detail the specific criteria for approval, must be used to solicit responses from qualified analytical laboratories. Ability to perform work in accordance with SW-846 and EPA Contract Laboratory Program (CLP) protocol must be included as requirements.

Audits and surveillances, in accordance with procedure QAPP-10, must be performed at laboratories providing analytical support to the WSSRAP to ensure that the laboratory meets the requirements of the technical specification and to monitor laboratory performance.

ENVIRONMENTAL DATA AUDIT DOCUMENTATION



ENVIRONMENTAL DATA AUDIT DATA FLOW DIAGRAM

FIGURE 2-2

REPORT NO.:	DRAWING NO.: A/PI/021/0590	
ORIGINATOR: LDP	DRAWN BY: GLN	DATE: 5/90

QA surveillances shall also be periodically performed on various WM activities in accordance with procedure SQA-2a. These surveillances monitor compliance with site policies, procedures, and regulatory requirements.

2.5 Training

All WMG personnel involved in sampling, characterization, or data evaluation must be trained in accordance with the *Waste Management Training Plan* (MKF and JEG 1992b). Additionally, persons performing analysis in the waste management field laboratory must be trained according to the *Laboratory Chemical Hygiene Plan* (MKF and JEG 1991a) as required by Occupational Safety and Health Administration (OSHA).

3 SAMPLING METHODS

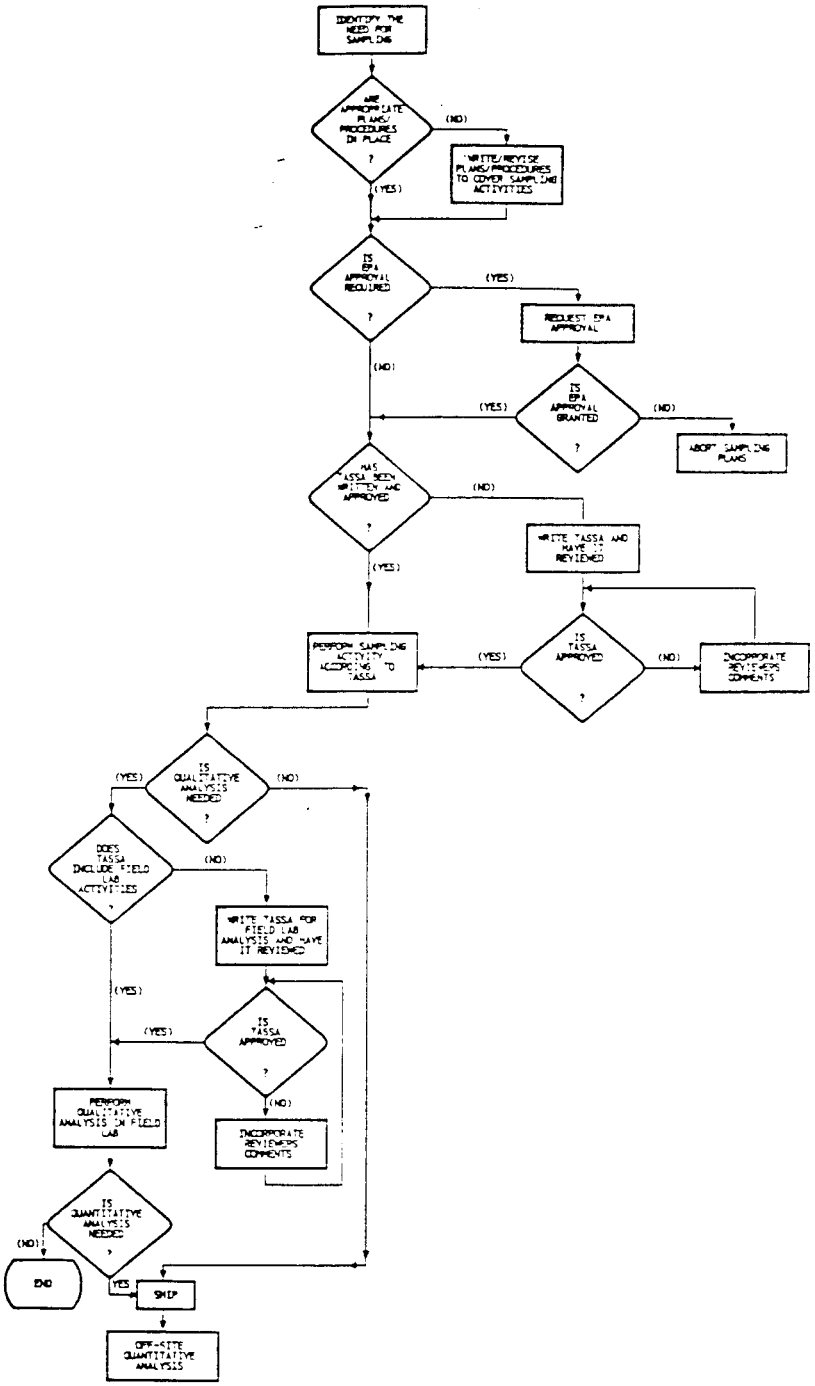
Sampling requires collecting representative samples of the waste and is performed with both accuracy and precision to increase the validity of the waste analysis. The sampling method of choice must be capable of providing both a horizontally and vertically representative sample of the waste material being sampled. The sampling methods and equipment used for sampling waste materials will vary with the form and consistency of the waste materials. The wide variety of waste types and containment devices present at the Weldon Spring site (WSS) makes it impossible to recommend a universal sampling procedure. Procedure RC-24s details the requirements for sampling containers such as drums, bags, cans, and bottles as well as swipe sampling and volumetric sampling of porous materials such as wood and concrete. Detailed sampling plans specific to waste types and configurations will be developed as necessary to support site activities. These plans must detail sampling methods, locations, number of samples, and data quality objectives to be utilized to ensure that sufficient data are obtained to adequately characterize all wastes. Figure 3-1 details the sampling process and sampling plan development logic.

3.1 General

All waste management sampling activities will require that the task be detailed daily as required by procedure CM&O-15a *Task Specific Safety Assessment* (TaSSA) . The TaSSA will specify, at a minimum, the material to be sampled, the sampling equipment to be utilized, and manpower requirements. At a minimum, waste management sampling teams will consist of two persons.

Appropriate air monitoring measurements listed on the TaSSA will be made to assess the possibility of the container holding volatile or flammable constituents and to assist in determining appropriate protective measures to be implemented by the sampling team and all support personnel.

Sufficient volume of a sample, adequate in size for all needs such as laboratory analysis and quality control, and splitting with other organizations, must be collected. Samples for detailed laboratory analysis must be collected in sufficient volume (where possible) to analyze the sample volume specified in the appropriate analytical methodology, including quality control samples. Samples of wastes known to contain high concentrations of hazardous components



REQUIREMENTS PRIOR TO THE SAMPLING PROCESS

FIGURE 3-1

REPORT NO.:		EXHIBIT NO.: A/PI/124/0792	
ORIGINATOR: LDP	DRAWN BY: SRS	DATE: 7/92	

require only a small aliquot for analysis. Samples requiring preservation (see Table 3-1) will have the appropriate preservation agent added in the field. Sample containers shall be filled to capacity when possible. The use of metal sample containers must be avoided. Wide-mouth brown glass bottles or jars with teflon lined closures are the preferred sample container. In all instances, however, the sample container must be compatible with its proposed contents.

A representative sample is crucial to characterization of the waste and is dependent upon proper selection of sampling points. No single series of sampling points can be specified for all types of receptacles. Table 3-2 lists examples of common types of receptacles used for waste materials and the corresponding recommended sampling equipment. Extreme care must be exercised to overcome stratification or encapsulation that may inhibit obtaining a representative sample. If stratification is suspected, several vertical "core" samples may be required to be consolidated as a representative sample. In the event of suspected encapsulation, several vertical and horizontal cross sectional cuts may be required to determine the degree of encapsulation proper to sampling.

Sampling procedures vary depending on the medium sampled (liquid, semisolid, or solid) and the type of structure containing the waste. The following discussion addresses procedures that are recommended for sampling wastes in various media and types of containers. Environmental compliance procedure RC-24s details the sampling process. When collecting samples for volatile organics analysis, care must be exercised to avoid unnecessary mixing or agitation that may volatilize or lose analytes of interest and lead to the generation of erroneously low results.

3.2 Sampling Strategies

Sampling methods employed at the Weldon Spring Site Remedial Action Project (WSSRAP) will vary depending on the nature and extent of known or suspected contamination, the information desired, and the end use of the data. Simple random sampling will be utilized as a probable statistical technique for obtaining accurate and precise samples when no information on the chemical or radiological properties of a waste are available. In random sampling, every unit in the waste population has a theoretically equal chance of being sampled and measured. The method of choice at the WSS for selecting a random sample is to divide the

TABLE 3-1 Required Containers, Peservation Techniques, and Holding Times For Wastes Samples*

Name	Container[a]	Preservation	Maximum holding time
Inorganic Tests:			
Bromide	P,G	None required	28 days
Chloride	P,G	None required	28 days
Cyanide, total and amenable to chlorination	P,G	Cool, 4°C, NaOH to pH>12, 0.6g ascorbic acid	14 days
Fluoride	P	None required	28 days
Hydrogen ion (pH)	P,G	None required	Analyze immediately
Kjeldahl and organic nitrogen	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Moisture	P,G	None required	
Nitrate-nitrite	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Oil and grease	G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Organic carbon	P,G	Cool, 4°C, HC1 or H_2SO_4 to pH<2	28 days
Phenols	G only	Cool, 4°C, H_2SO_4 to pH<2	28 days
Phosphorus, total	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Residue, total	P,G	Cool, 4°C	7 days
Residue, Nonfilterable (TSS)	P,G	Cool, 4°C	7 days
Residue, Settleable	P,G	Cool, 4°C	48 hours
Residue, Volatile	P,G	Cool, 4°C	7 days
Sulfate	P,G	Cool, 4°C	28 days
Sulfide	P,G	Cool, 4°C, add zinc acetate plus sodium hydroxide to pH>9	7 days
Metals:			
Chromium VI	P,G	Cool, 4°C	24 hours
Mercury	P,G	HNO_3 to pH<2	28 days
Metals, except chromium VI and mercury	P,G	HNO_3 to pH<2	6 months
Sulfite	P,G	None required	Analyze immediately
Viscosity	P,G	None required	
Sulfur	P,G	None required	
Asbestos	P,G	None required	
Paint Filter Test	P,G	None required	
Heating Value (BTU)	G	None required	

* Aqueous Samples that are highly acidic (pH<2) or causitc (pH>12) or concentrated waste samples no preservation is required.

[a] Polyethylene (P) or Glass (G)

TABLE 3-1 Required Containers, Peservation Techniques, and Holding Times For Wastes Samples* (Continued)

Name	Container[a]	Preservation	Maximum holding time
Organic Tests:			
Purgeable Halocarbons	G, Teflon-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$	14 days
Purgeable aromatic hydrocarbons	G, Teflon-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$, HC1 to pH2	14 days
Acrolein and acrylonitrile	G, Teflon-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$, Adjust pH to 4-5	14 days
Phenols	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$	7 days until extraction, 40 days after extraction
Benzidines	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$	7 days until extraction
Phythalate esters	G, Teflon-lined cap	Cool, 4°C	7 days until extraction 40 days after extraction
Nitrosamines	G, Teflon-lined cap	Cool, 4°C, store in dark, 0.008% $Na_2S_2O_3$	40 days after extraction
PCBs, acrylonitrile	G, Teflon-lined cap	Cool, 4°C	40 days after extraction
Nitroaromatics and isophorone	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$ store in dark	40 days after extraction
Polynuclear aromatic hydrocarbons	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$ store in dark	40 days after extraction
Haloethers	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$	40 days after extraction
Chlorinated hydrocarbons	G, Teflon-lined cap	Cool, 4°C	40 days after extraction
TCDD	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$	40 days after extraction
Total organic halogens	G, Teflon-lined cap	Cool, 4°C, H_2SO_4 to pH<2	7 days
Pesticides Tests:			
Pesticides	G, Teflon-lined cap	Cool, 4°C, pH 5-9	40 days after extraction
Radiological Tests:			
Alpha, beta and radium	P,G	HNO_3 to pH<2	6 months

* Aqueous Samples that are highly acidic (pH<2) or causitc (pH>12) or concentrated waste samples no preservation is required.

[a] Polyethylene (P) or Glass (G)

TABLE 3-2 Sampling Equipment for Selected Waste and Containers

Waste Type	Drum		Sacks & Bags	Small Bottles[a] & Cans	Tanks or Bins	Waste Piles	Sumps, Pits, & Lagoons	Pipe	Equipment & Items
	Bung Type	Open Top							
Liquids and slurries	(b)	(b)	NA	Glass Tube	Weighted bottle or Coliwasa	NA	Weighted Bottle/ Dipper	Dipper /Swipe	Grab/Swipe
Sludges	Trier/ Dipper	Trier/Dipper	NA	Trier	Trier	(c)	(b)	Dipper	Dipper
Moist powders or granules	Trier	Trier	Trier	Thrier	Trier	Trier	Trier	Dipper	Dipper
Day sand, powders, or granules	Thief	Thief	Thief	Thief	(c)	(c)	Trier/Thief	Dipper	Dipper
Sand or packed solids	Auger	Auger	Auger	Auger	(c)	Thief/ Auger	Auger	Dipper	Dipper/Scoop
Solid sheets or rods	NA	Grab	Grab	Grab	NA	Grab	NA	NA	NA
Wood	NA	(c)	NA	NA	NA	(c)	(c)	NA	NA
Concrete	NA	Auger	(d)	(d)	NA	(c)	NA	NA	NA

a Generally less than 10 gallon total volume.
b Approved sampling equipment (coliwasa, glass tube, dipper, vac sam or peristaltic pump) to be selected based on quantity and homogeneity of waste.
c Sampling equipment must be selected based on waste conditions and configuration on a case-by-case basis.
d If loose powder use device as indicated for dry sand, powder, or granules, otherwise use on auger.

population by an imaginary grid, assign a series of consecutive numbers to the units of the grid, and select the units to be sampled through the use of a random numbers table.

This principle can also be applied when the waste population to be sampled consists of a collection of discreet units such as drums, telephones poles, railroad ties, and pieces of equipment. In this instance, each unit is assigned a consecutive number and the units to be sampled are selected through the use of a random numbers table.

Systematic random sampling can be useful when contamination is known (or suspected) and the boundaries of the contamination zone must be determined. In this type of probability sampling, the first sample to be collected from a population is randomly selected, but all subsequent samples are taken at fixed space or time intervals. Table 3-3 indicates the number of samples required for various container or grid populations.

Composite sampling is utilized when the proposed sample population is very large and analytical costs are a factor, as well as when sample volumes from units are insufficient for analysis when taken individually. In composite sampling, a number of random samples are initially collected from a waste and combined into a single sample, which is then analyzed for the chemical contaminants of concern.

Grab sampling is utilized when discreet units are taken as samples and when knowledge is desired on batches from continuous generation operations.

Swipe sampling is used when knowledge is desired about surface contamination. This form of sampling is useful in determining if hazardous residuals from spills or processes may be present on floors, equipment, and process vessels such as tanks and piping.

Volumetric sampling is utilized on porous materials such as wood or concrete to determine the extent of penetration of the contaminant of interest. It involves boring or coring holes into the material to predetermined depths and removing samples for analysis.

A number of factors in addition to statistical considerations will influence sampling strategies. Obviously, one of the most important factors is the waste and its properties. The following waste properties are examples of what must be considered when choosing a sampling strategy.

TABLE 3-3 Sample Quantities for Various Waste Populations

Population	Number of units to be sampled
1-10	5
11-15	7
16-20	8
21-30	10
31-40	13
41-50	15
More than 50	Minimum of 33%

- Physical state: The physical state of the waste will affect most aspects of a sampling effort. The sampling device will vary according to whether the sample is liquid, solid, or multiphasic. If the waste is a liquid, consideration must be given to whether it is viscous or free-flowing. If it is a solid, consideration must be given to whether the solid is hard or soft, powdery, or clay-like.

  The sampling strategy will have to vary if the physical state of the wastes allows for stratification, homogenization, or random heterogeneity.

- Volume: The volume of the waste, which must to be represented by the samples collected, will have an effect upon the choice of sampling equipment and strategies. Sampling the raffinate pits requires a different approach from sampling a drum. Although a drum may be sampled with a coliwasa or drum thief, a weighted bottle may be required to sample a 20 ft tank.

- Hazardous properties: Safety and health precautions and methods of sampling and shipping will vary dramatically with the toxicity, ignitability, corrosivity, and reactivity of the waste.

Site-specific factors such as accessibility must be considered when designing a sampling strategy. The accessibility of waste can vary substantially. Some wastes are accessed simply by opening a drum; others may require that a tank be emptied or a container excavated.

3.2.1 Sampling Drum

Access to a drum will affect the number of samples that can be taken from the drum and the location within the drum from which samples can be taken. Bung top drums, which generally indicate the presence of liquids or sludges, limit access to the contained waste and restrict sampling to a single vertical plane.

Such drums will be positioned with the bung in an upright position. The bung will be slowly loosened using a non-sparking bung wrench allowing any gas pressure to release. If the bung cannot be removed or loosened it may be necessary to remove the top of the drum or other method to gain access to the material.

If the material is known to be homogeneous, a coliwasa, glass tube, vacsam sampling pump, or peristaltic sampling pump may be used to collect the sample. However, for most drums on the WSS the extent of homogeneity of the material cannot be verified and mixing of liquids will be required prior to sampling with the above equipment.

For sludge or solids, the top of the drum will be removed to allow better access to the material. The surface of the waste will then be divided into an imaginary grid composed of eight sections as detailed by procedure RC-24s and selecting a minimum of five grid points to be sampled. Each selected grid point will then be sampled in a vertical manner along the entire length from top to bottom of the drum. These samples will then be composited to form a single sample.

3.2.2 Sampling Barrels, Fiberdrums, Bags, or Sacks, Containing Powder, Granular, or Packed Solids

Where possible containers will be positioned upright prior to sampling. If possible, sacks or bags will be sampled as found to avoid rupturing them and spilling the contents.

The container will be opened slowly and in such a manner so as to minimize the generation of airborne contaminants. For drums, the surface of the waste will be divided into an imaginary grid composed of eight sections and a minimum of five grid points will be selected for sampling. Each selected grid point will then be sampled in a vertical manner along the entire

length from top to bottom using an auger, trier, thief, scoop, or shovel. A composite sample will then be created from these samples.

3.2.3 Sampling a Tank

Tanks can generally be viewed as large containers or drums. Thus, in many cases, the principles that are applied to sampling a drum can also be applied to sampling a tank.

The majority of tanks found at the WSSRAP are found at the Weldon Spring Chemical Plant (WSCP) and were present when the plant was closed. These tanks have been visually inspected and the majority were found to be empty.

For tanks located within the structures at the WSCP, a team of representatives from various departments of the Project Management Contractor (PMC) is required to assess the best means of approaching and gaining access to the tank because of the generally poor physical condition of the buildings. This assessment will also attempt to determine the best location to obtain the sample. Normally the sample can be obtained through the sampling hole or hatch which is usually located at the top of the tank. In some instances it may be necessary to remove a flange or a pipe to gain access to a tank. If no other access point is available, a sample may be obtained through a bottom valve. Such a sample will generally not be representative of the overall tank contents and must be documented on the waste management sampling data form as required by procedure RC-24s.

For tanks containing liquids, a measurement of the depth of the liquid in the tank shall be made using a weighted line or rigid pole and measuring the length of stain on the device.

If a tank is equipped with a recirculating pump, the pump should be activated and the contents of the tank allowed to mix for a minimum of 5 min prior to sampling. A sample can then be collected using a coliwasa, peristaltic pump or a vacuum pump.

If the tank is not equipped with a recirculating pump, a sample will then be collected from selected depths using a weighted bottle depending on the estimated volume of waste in the tank. A coliwasa can also be used to sample in a vertical manner along the entire length from top to bottom if a coliwasa of sufficient length is available.

In some instances, it may be more feasible to obtain a sample for detailed analysis as the contents are being transferred to new containers or drums. In this instance, samples can be collected at random intervals during the transfer process or by collecting samples from the containers or drums after the transfer is complete.

If the tank is an open one, allowing unrestricted access, then a representative set of samples is usually obtained by dividing the tank into an imaginary three-dimensional grid and assigning sections numbers. Specific levels and grid locations are then sampled using a random number table.

3.2.4 Sampling a Pit, Pond, or Sump

Wastes found in pits, ponds, or sumps may range from liquids to dried sludge residues. Liquid or semi-solid wastes in these configurations are often best sampled using strategies applicable to large tanks.

If the pit, pond, or sump is sufficiently small, it may be sampled from the banks or edges or by use of a catwalk or bridge. For pits or ponds greater than 12 ft across, a boat or other such device may be required. In either case, the requirements for working on or near water as detailed in procedure SAFE-8a must be met.

The surface of the area to be sampled will be divided into an imaginary grid. The number of grid sections will be determined by the desired number of samples to be collected. Samples will be collected from random points on the grid and in various depths in accordance with procedure ES&H 4.3.1s. Based on the findings of these activities, composite samples will be created by combining compatible samples as determined by RC-26s.

Compressed air or other circulating devices may also be utilized to mix the waste within a pit or sump in order to improve the homogeneity of the waste prior to sampling. In this manner any solids or sediments that may have settled will be resuspended or dissolved prior to sampling.

A ponar sampler lowered to the bottom of the pond, pit, or sump by a rope or cable may be used to sample sediments or sludges that may have settled if that is to be the focus of the sampling activity.

A weighted bottle may be used to sample liquids. A peristaltic or vacuum pump may be used if the waste can be made homogeneous. A coliwasa may even be used if the pit, pond, or sump is sufficiently shallow.

Hollow-stem augers and/or split-spoon samplers are appropriate for sampling solids. Water-driven or water-rinsed coring equipment should not be used for sampling because the water can rinse chemical components from the sample. Excavation equipment may be useful in obtaining samples at various depths or in gaining access to buried targets. The resulting holes may be useful for viewing and recording information on buried debris or stratified materials.

3.2.5 Sampling a Waste Pile

A waste pile can range from a small heap to a large aggregate of wastes. The wastes are predominantly solid and can be mixtures of powders, granules, and large chunks and may be composed of wood, metal, plastic, or other debris. Obtaining a representative sample through the employment of a universal sampling procedure is not possible and therefore must be addressed on a case-by-case basis. When samples are required from a waste pile, a unique sampling plan will be prepared by the Waste Management Group in an effort to obtain accurate and representative samples.

The accessibility of waste within a waste pile is usually a function of pile size. Ideally, piles containing unknown wastes are sampled using a three-dimensional random sampling strategy. If sampling is limited to certain portions of the pile, then the collected sample will be representative only of those portions, unless the waste is known to be homogeneous.

Samples from the temporary storage area (TSA) or material storage area (MSA) should be taken from the truckloads used to create the pile prior to the waste being placed in the pile, where possible.

The sampling devices most commonly used for small piles include thief, triers, and shovels.

3.2.6 Sampling a Pipe

Sampling the contents of a pipe can present unique and difficult problems. Identifying a sampling point that may yield a representative sample may not be an easy task.

Available drawings from the WSCP, which detail the piping configurations, will be reviewed in an effort to tentatively identify the materials that may be present in the piping system as well as potential sampling points. If sufficient information cannot be obtained from these drawings, visual inspections by a group of representatives from various PMC departments will be performed to determine appropriate sampling points. This assessment is detailed in the *Building Characterization Work Plan* (MKF and JEG 1991b).

A hole can be drilled in the top of a pipe to gain access if no valve, fitting, or flange is present at or near the chosen sampling point. The hole must be sufficiently large to allow access to the waste by the chosen sampling device.

For active piping systems, sampling ports or valves must be utilized to obtain samples from the process.

Swipes may be utilized to determine the presence of residues within piping systems.

3.2.7 Volumetric Sampling of Concrete and Wood

Many areas at the WSSRAP have been found to be chemically contaminated from spills that occurred during the active life of the facility. For porous surfaces such as concrete and wood, it is imperative that the extent of migration of these materials be determined to determine management practices for these wastes.

For concrete surfaces and flat wood surfaces, the surface area to be sampled will be divided into an imaginary grid. The number of grid sections will be determined by the desired number of samples to be collected in accordance with guidelines established in SW-846. Samples will be collected by boring at random points on the grid to various depths in accordance with procedure RC-24s.

For wood materials such as railroad ties or telephone poles, random boring samples from various locations within the material will be consolidated. The number of samples to be collected and the number of composites required shall be determined based on the population available to be sampled.

For floors and flat surfaces, samples will be collected in areas where visible residues are on the floor and/or swipe sample data has shown residues to be present by establishing an imaginary grid system. Samples can be collected using a drill with masonry bits and a scoop or vacuum pump to collect the material.

Samples will be collected by drilling to a predetermined depth at selected points within the sample location. Sampling at selected increments should continue to a predetermined maximum depth. After each depth increment has been completed and the sample collected, the sample location area must be wiped clean of any residues using a paper towel or masselin cloth.

A minimum of five and a maximum of 20 spots should be composited within each grid location chosen for sampling. Less than five spots generally will not yield enough material to compromise a sample. However, if a sample location has been identified where the total surface area is less than 4 in.^{2}, it may not be possible to sample more than five spots. Using 20 samples as a maximum gives a valid representation of a large area. The representation will be optimum if the entire area is visibly oil stained and/or swipe data indicate the presence of residues in the entire area to be sampled. For areas where no visible stains are present, a grid system will be used in accordance with procedure RC-24. Regardless of size or how the area is laid out, all samples should be collected using a symmetrical method of sampling.

Most floors on site are structurally sound. However, some areas of known contamination may be cracked throughout. If this is the case, sampling must be performed along a representative distance of the crack. All sample locations will be identified on respective building drawings. These drawings will be included in the final characterization report.

3.2.8 Sampling Soil

The techniques for soil sampling are numerous. The procedure utilized at the WSS is detailed in procedure ES&H 4.4.5s. This procedure is consistent with the objective of collecting

soil samples to determine the amount of hazardous material deposited on a particular area of land.

3.2.9 Sampling for Determining the Radioactive Component of a Waste

Before wastes can be released off-site to an unlicensed facility, they are required to be certified to have nondetectable or background levels of radioactivity in accordance with procedure RC-32s. This requirement applies to all wastes originating and/or stored within the radioactive material management area (RMMA) and applies only to radionuclides from the natural U-238, U-235, and Th-232 decay series.

For wastes with a potential for volumetric contamination, at least three representative samples, adequate in size to perform radiological parameters, must be taken from the waste quantity. If radionuclides are heterogeneously dispersed within the waste, the coliwasa sampler or similar method must be used to obtain sample aliquots from the top, middle, and bottom of the waste quantity in accordance with RC-24s.

At least three samples must be taken from a matrix similar to the waste matrix except each matrix shall be known to be free of radioactivity in excess of naturally occurring levels. Each matrix will be approved on a case-by-case basis by the Waste Management Manager or his designee. For example, motor oil purchased from an auto parts store is similar to oils used at the WSS. Samples from the matrix must be collected in the same manner as potentially contaminated samples.

Samples must be analyzed radiochemically by an approved method detailed in this plan to measure radioactivity in excess of the lower limit of detection (LLD) in samples known to be free of radioactivity in excess of natural background levels.

Data must be evaluated and documented in accordance with the guidelines contained in procedure RC-32s.

Waste materials can be determined not to contain radioactivity based on process knowledge. Process knowledge includes information on the origin, storage, use, and potential exposures of the waste material. Process knowledge principally applies to sealed containers (e.g., pressurized paint cans, laboratory reagents, and motor oils); however, bulk materials may

also be included. For example, large containers used as stock may be used for dispersal into smaller containers.

Criteria for designating materials nonradioactive per process knowledge are:

- The material must originate outside the RMMA. The approximate date the material was received on site must be recorded on the certification form. Information on purchased materials can be obtained through the Procurement Department.

- Documentation showing that the material has been tracked and controlled since received on site by specifically identifying the time and on-site locations during the life of the material.

- Proof that the material has not been exposed to known radioactivity. Possible exposures include direct contact with contaminated waste via mixing and exposure to airborne contamination via open containers. A statement on the use of the material must be included on the certification form.

4 WASTE ANALYSIS

Chemical analysis of the waste materials at the Weldon Spring Site Remedial Action Project (WSSRAP) is intended to identify hazardous characteristics or hazardous components present in each waste. It is also designed to provide information to ensure safe storage of the materials in compliance with all applicable regulations. In some cases, analytical data will provide the basis for choosing an appropriate means of treatment or disposal for a particular material.

The analytical procedures chosen for this *Waste Analysis Plan* can be divided into two groups: (1) field analyses; and (2) laboratory analysis.

Field analyses are intended to provide general information such as functional groups, general hazard class, and chemical compatibility for the purposes of consolidation and confirming label information if necessary. These tests, which will be performed at the Weldon Spring site (WSS), can also be used to determine the appropriateness of additional laboratory analyses.

Laboratory analysis, where appropriate, will provide more detailed information about the hazardous components or constituents of the waste. Laboratory analysis may also be required to determine exact concentrations of materials shown to be present during field analyses. In most instances, detailed laboratory analysis will be performed on containerized wastes after wastes have been consolidated or placed in their final storage containment.

The following sections contain a discussion of the analytical methodology appropriate to the general categories of wastes at the WSSRAP as well as the logic for choosing each analysis. It is conceivable that, during the course of this project, additional methodologies and technologies will become available. As these methodologies are identified and determined to be amenable to the wastes at the Weldon Spring site, they will be procedurialized, reviewed and approved by the Project Management Contractor (PMC).

4.1 Field Analyses

The procedures employed for chemical categorization of wastes in the field are organized into the procedural sets summarized below. These qualitative procedures are designed to provide

general information concerning the material being tested. These tests are detailed in procedure RC-21s and RC-37s. If specific analyte concentrations are desired, representative portions of the waste must be submitted for laboratory analysis.

Knowledge of the functional groups present may be sufficient to determine the gross composition of the waste and minimize the need for more extensive laboratory analysis by allowing classification into a given reactivity group (see Table 4-1). The appropriateness of using any of the field testing procedures, prior to or in lieu of more sophisticated instrumental techniques, is left to the professional judgement of the supervising engineer. Figure 4-1 shows an example of a decision tree for determining the appropriateness of any field test to any given waste.

4.1.1 pH

Measurement of the pH aids in the identification of acids and bases and allows determination of proper handling, packaging and storage requirements. pH also indicates whether neutralization may be required as part of the treatment or disposal process (see Figure 4-1).

4.1.2 Redox

The oxidizing or reducing potential of a waste material is identified by this procedure. Due to the reactive nature of oxidizing and/or reducing agents, it is essential that these types of materials receive special packaging, handling and storage considerations. These materials must be segregated from all incompatible materials during storage (see Figure 4-2).

4.1.3 Solution-Reactivity and Special Functionality Tests

Treatment of the waste materials with water, a base, and various acids and solvents allows determination of its reactivity and solubility characteristics. This procedure allows identification of sulfides and cyanides, reactivity and solubility in acids and solvents, reactivity with water and the presence of water (see Figure 4-3).

TABLE 4-1 Reactivity Group Definitions

Reactivity Group No.	Reactivity Group Name
1	Acids, mineral, nonoxidizing
2	Acids, mineral, oxidizing
3	Acids, organic
4	Alcohols and glycols
5	Aldehydes
6	Amides
7	Amides, aliphatic and aromatic
8	Azo compounds, diazo compounds, and hydrazines
9	Carbamates
10	Caustics
11	Cyanides
12	Dithiocarbamates
13	Esters
14	Ethers
15	Fluorides, inorganic
16	Hydrocarbons, aromatic
17	Halogenated organics
18	Isocyanates
19	Ketones
20	Mercaptans and other organic sulfides
21	Metals, alkali and alkaline earth, elemental and alloys
22	Metals, other elemental and alloys in the form of powders, vapors, or sponges
23	Metals, other elemental and alloys as sheets, rods, moldings, drops, etc.
24	Metals and metal compounds, toxic
25	Nitrides
26	Nitriles
27	Nitro compounds
28	Hydrocarbons, aliphatic, unsaturated
29	Hydrocarbons, aliphatic, saturated
30	Peroxides and hydroperoxides, organic
31	Phenols and cresols
32	Organophosphates, phosphothioates, phosphodithioates
33	Sulfides, inorganics
34	Epoxides
101	Combustible and flammable materials, miscellaneous
102	Explosives
103	Polymerizable compounds
104	Oxidizing agents, strong
105	Reducing agents, strong
106	Water and mixtures containing water
107	Water reactive substances
108	Radioactively contaminated substances

FIGURE 4-1

FIELD TEST ANALYTICAL DECISION PROCESS

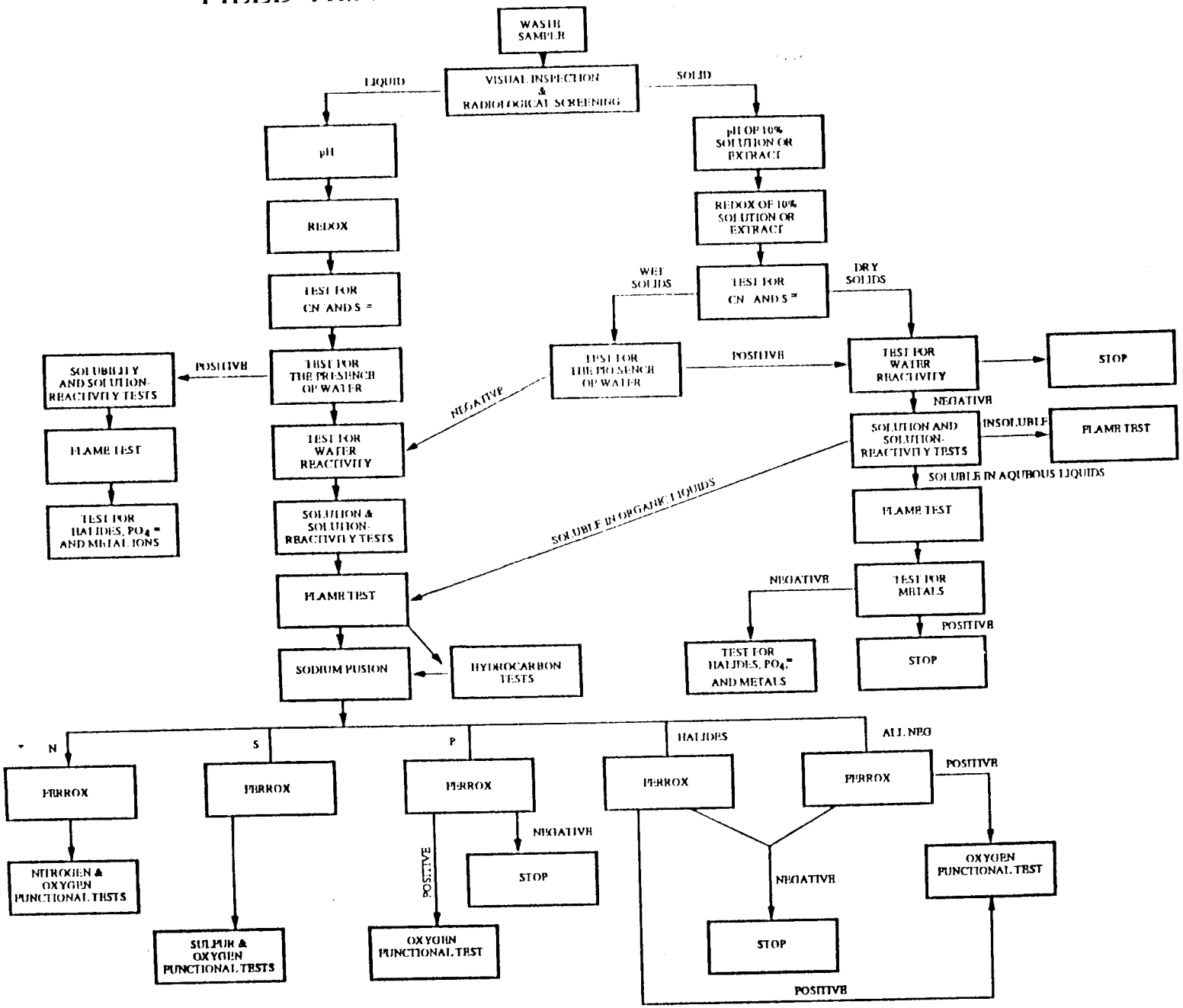


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FIGURE 4-2
pH AND REDOX TESTS

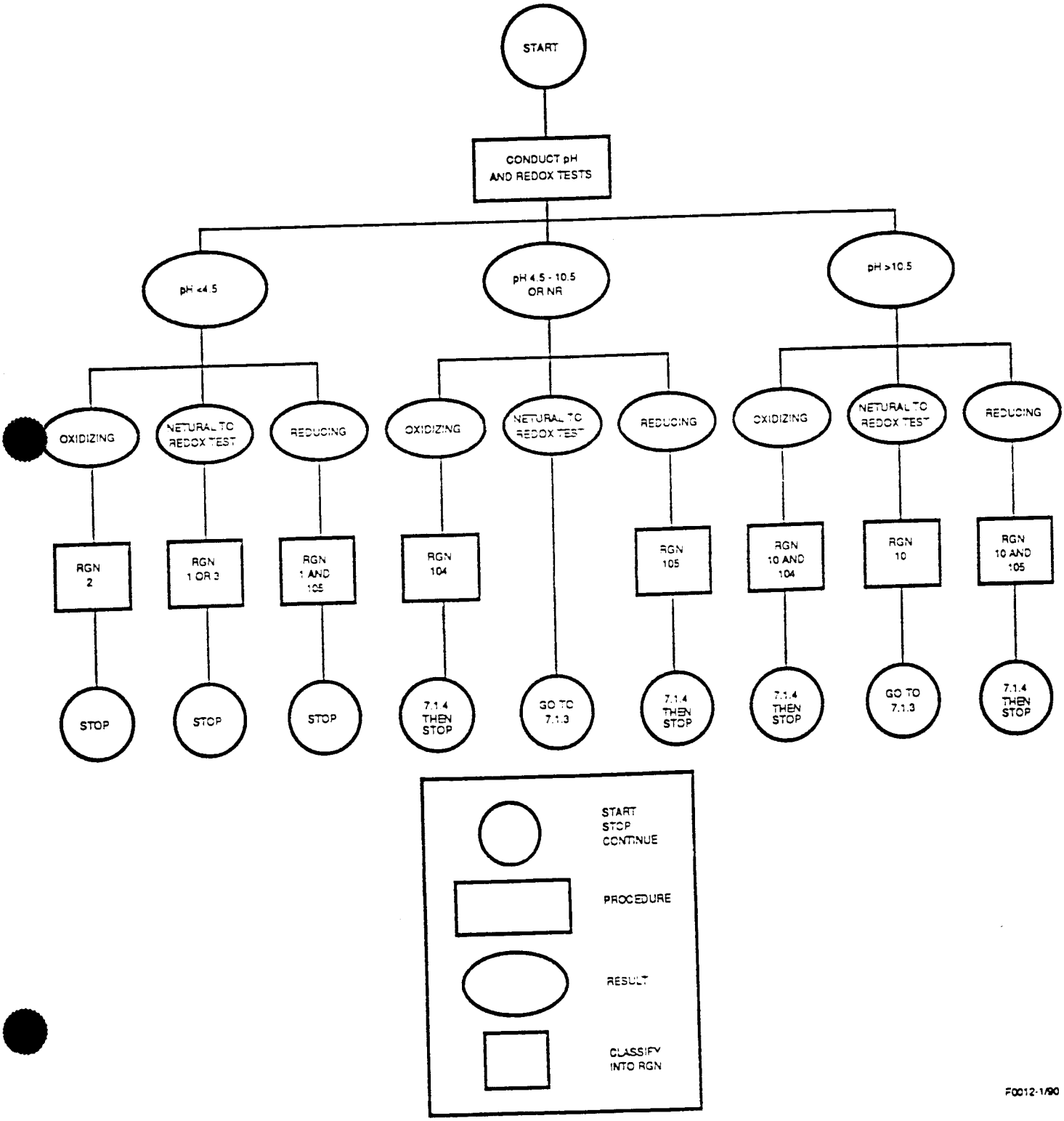

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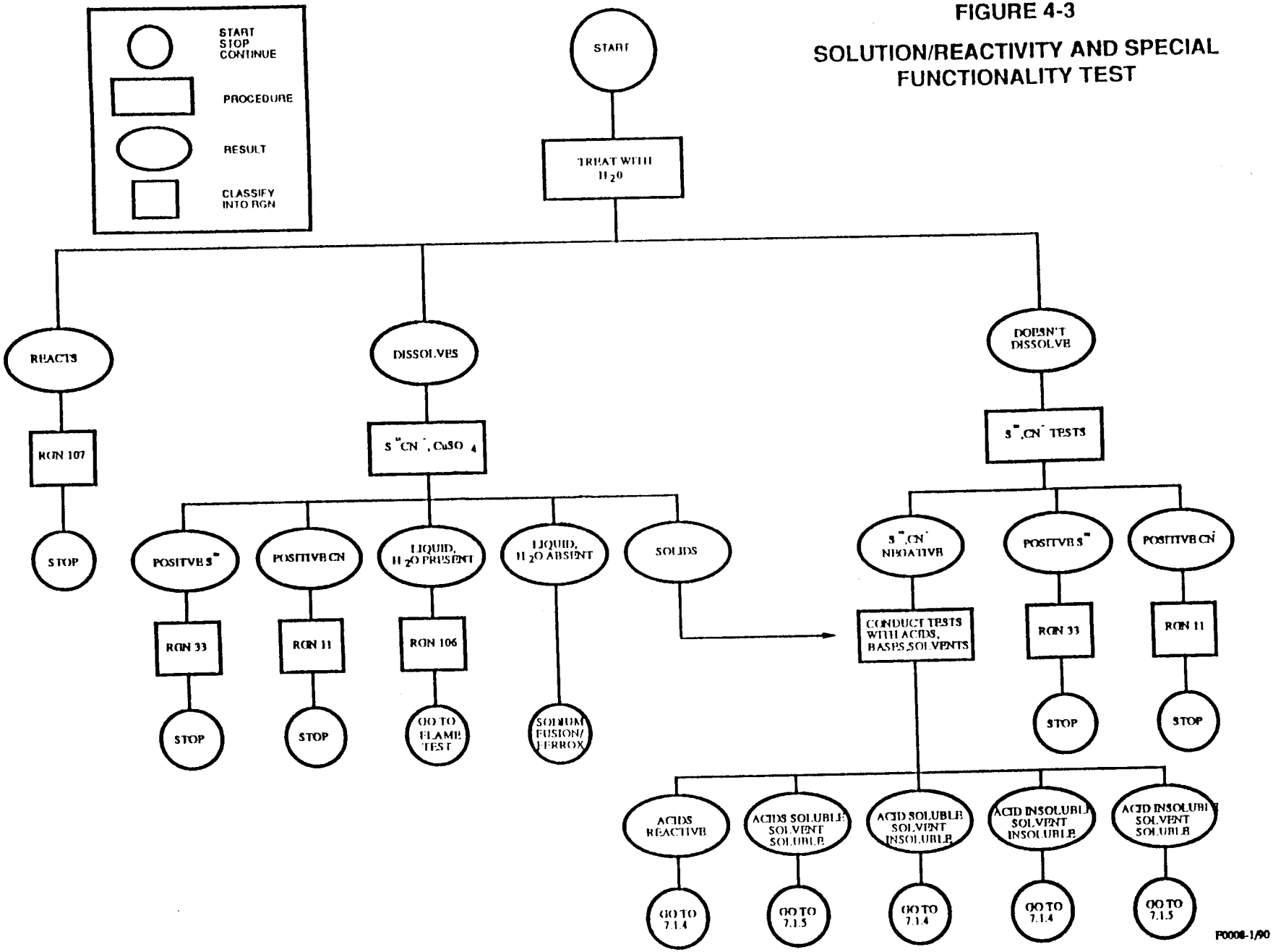
FIGURE 4-3

SOLUTION/REACTIVITY AND SPECIAL FUNCTIONALITY TEST



4.1.4 Flame Test

Observation of the behavior of a material upon ignition can provide a great deal of insight regarding its composition. The combustibility of a material as well as its explosive tendencies can be determined using this procedure. This test can also aid in classification as inorganics or organics (see Figure 4-4).

Halogenated organics presented in a waste may create a characteristic flame during this test.

4.1.5 Sodium Fusion

The sodium fusion test, which is performed on organic waste materials, allows determination of the presence of certain halogens (chlorine, bromine or iodine), sulfur, nitrogen and/or phosphorus (see Figure 4-5). The results obtained from this procedure and the ferrox test are used as a guide for which specific functionality tests are to be performed.

4.1.6 Ferrox Test

The ferrox test is performed on organic waste materials, in the absence of sulfur, nitrogen, or phosphorus, to determine the presence of oxygen (see Figure 4-5).

4.1.7 Organic Functionality Tests

This set of procedures includes specific tests, subdivided into four major subsets, for determination of 21 reactivity groups. Each of the procedure subsets for nitrogen or sulfur is performed only if the respective element is determined to be present in the sodium fusion test. If the element was found to be absent, it can be concluded that all reactivity groups determined in that subset are absent. Oxygen is assumed to be present if sulfur, nitrogen, or phosphorus is confirmed by the sodium fusion test; then the oxygen subset is performed in addition to the other appropriate functionality test.

FLAME TEST FLOW CHART

FIGURE 4-4

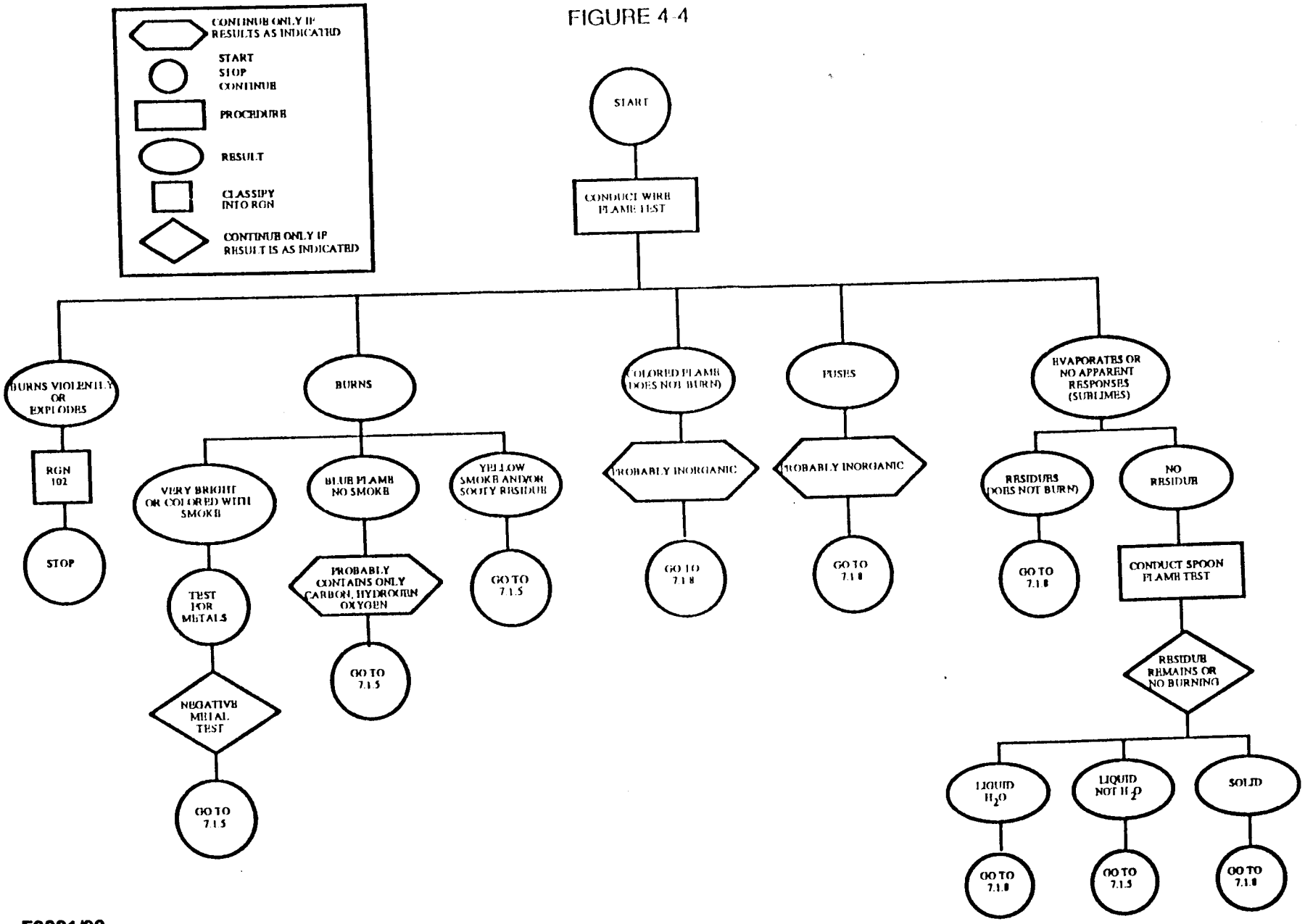


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FIGURE 4-5

SODIUM FUSION AND FERROX TEST FLOW CHART

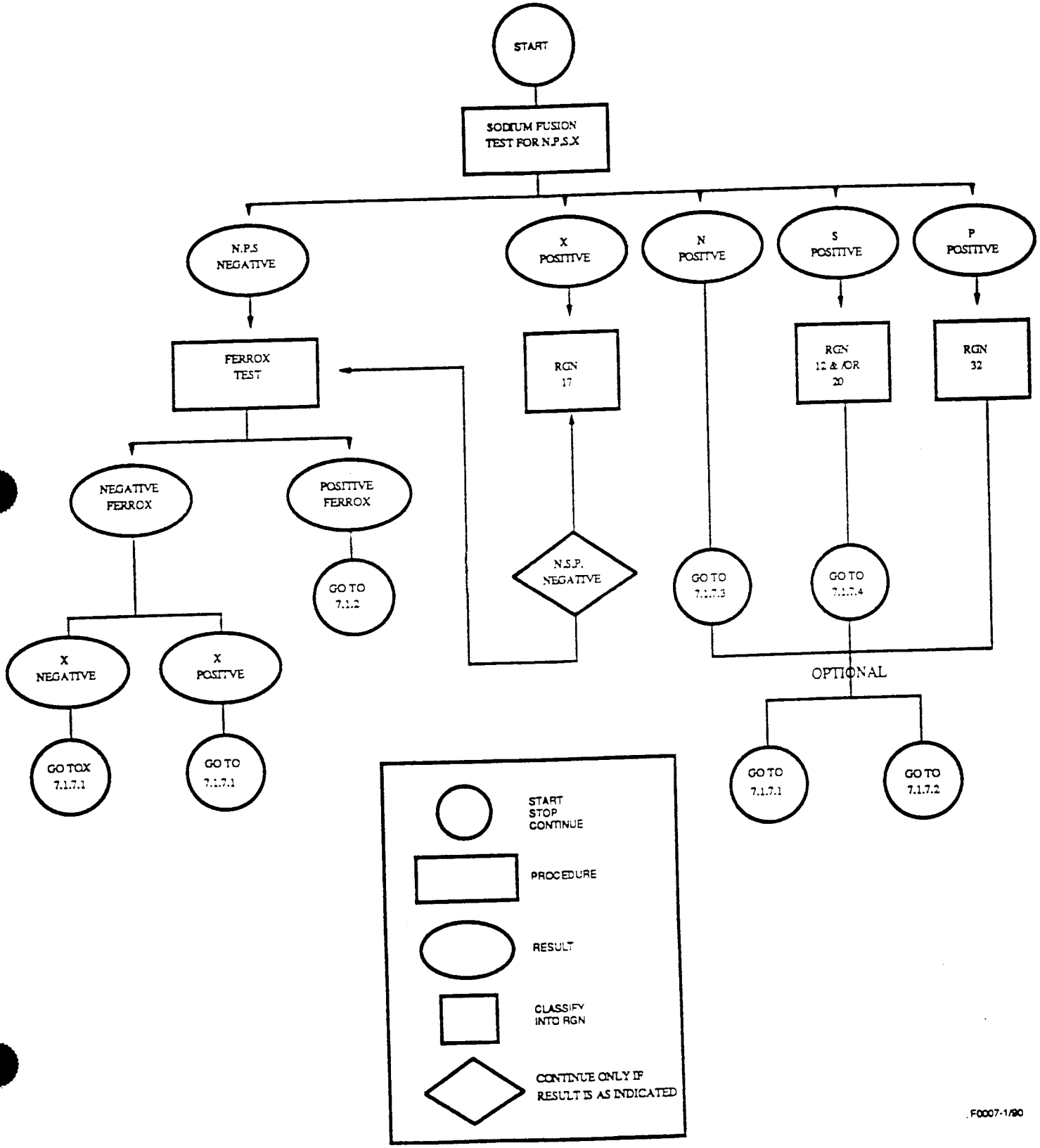

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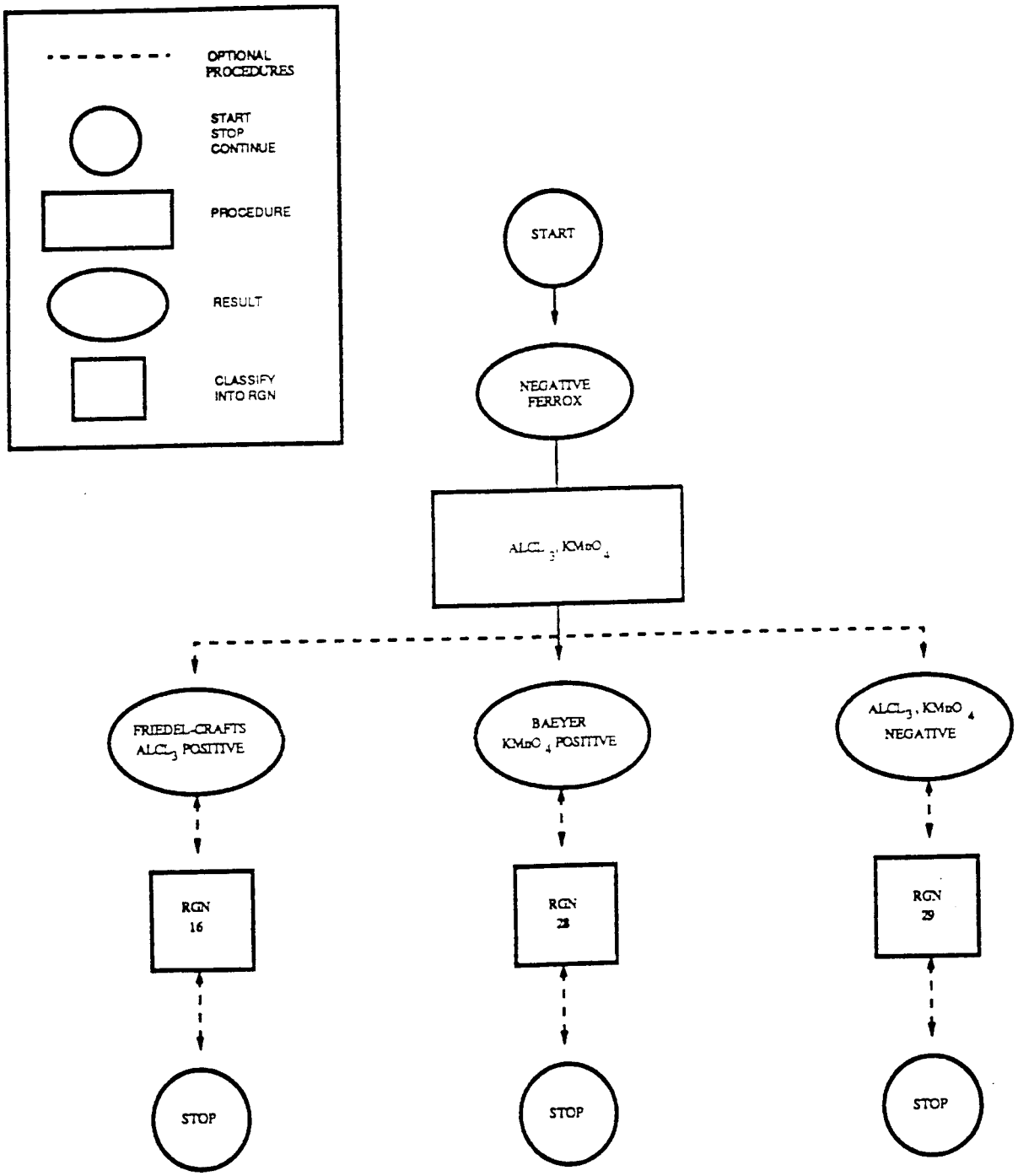
FIGURE 4-6

ORGANIC FUNCTIONALITY TESTS FOR HYDROCARBON CLASSIFICATION FLOW CHART



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4.1.7.1 Hydrocarbon Functionality Test

Saturated and unsaturated hydrocarbons and/or aromatic hydrocarbons are distinguished by this procedure. Due to the mutually exclusive nature of these reactivity groups, if one test is positive, the other need not be run (see Figure 4-6).

4.1.7.2 Oxygen-Containing Organic Functional Group Test

Nine specific reactivity groups can be distinguished by using this procedure. These tests are performed on all organic wastes except those shown to be negative for sulfur, nitrogen and phosphorus by the sodium fusion test and a negative ferrox test (see Figure 4-7).

4.1.7.3 Nitrogen-Containing Organic Functional Group Test

The tests for the seven reactivity groups in this subset are performed only if nitrogen is detected by the sodium fusion procedure (see Figure 4-8).

4.1.7.4 Sulfur-Containing Organic Functional Group Test

This procedure distinguishes the two reactivity groups contained within this subset (see Figure 4-9). If sulfur is shown to be absent in the sodium fusion procedure, this procedure need not be performed.

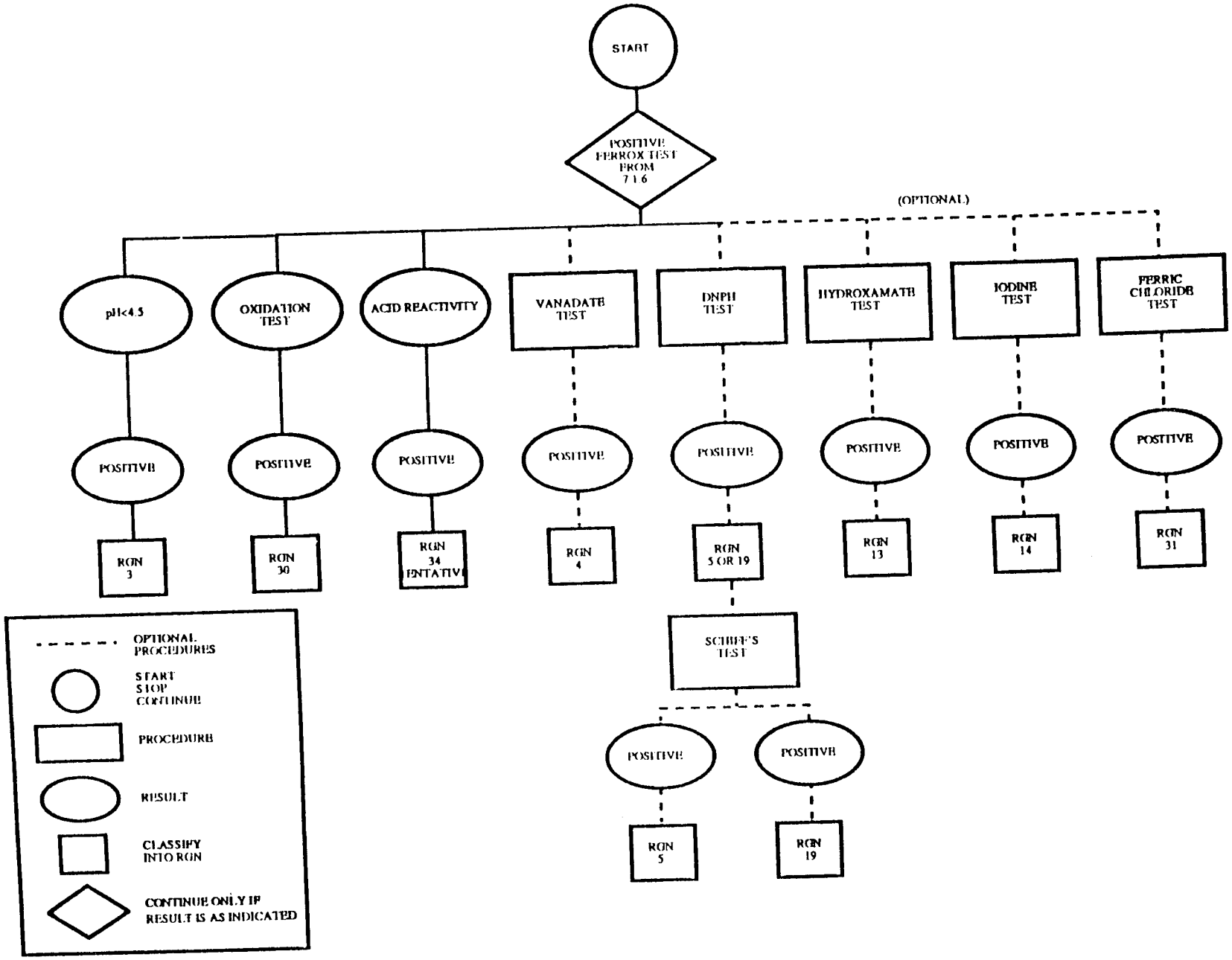
4.1.8 Inorganic Functionality Test

The presence of elemental metals, heavy metal compounds, halides, phosphates, and/or organic fluorides are confirmed by this procedure (see Figure 4-10). Additionally, semi-quantitative analyses can be performed in accordance with procedure RC-37s for selected parameters on aqueous and water soluble materials.

4.1.9 Geiger-Müller Counter Radiological Survey

Surface radioactivity is determined in the field using a Geiger Müller (G–M) counter as detailed in procedures ES&H 2.3.8 and 2.6.3. This will serve to indicate gross levels of contamination and determine the applicability of additional laboratory testing. If the GM survey

OXYGEN-CONTAINING ORGANIC FUNCTIONAL GROUP TEST FLOW CHART
FIGURE 4-7



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NITROGEN-CONTAINING ORGANIC FUNCTIONAL GROUP TEST FLOW CHART

FIGURE 4-8

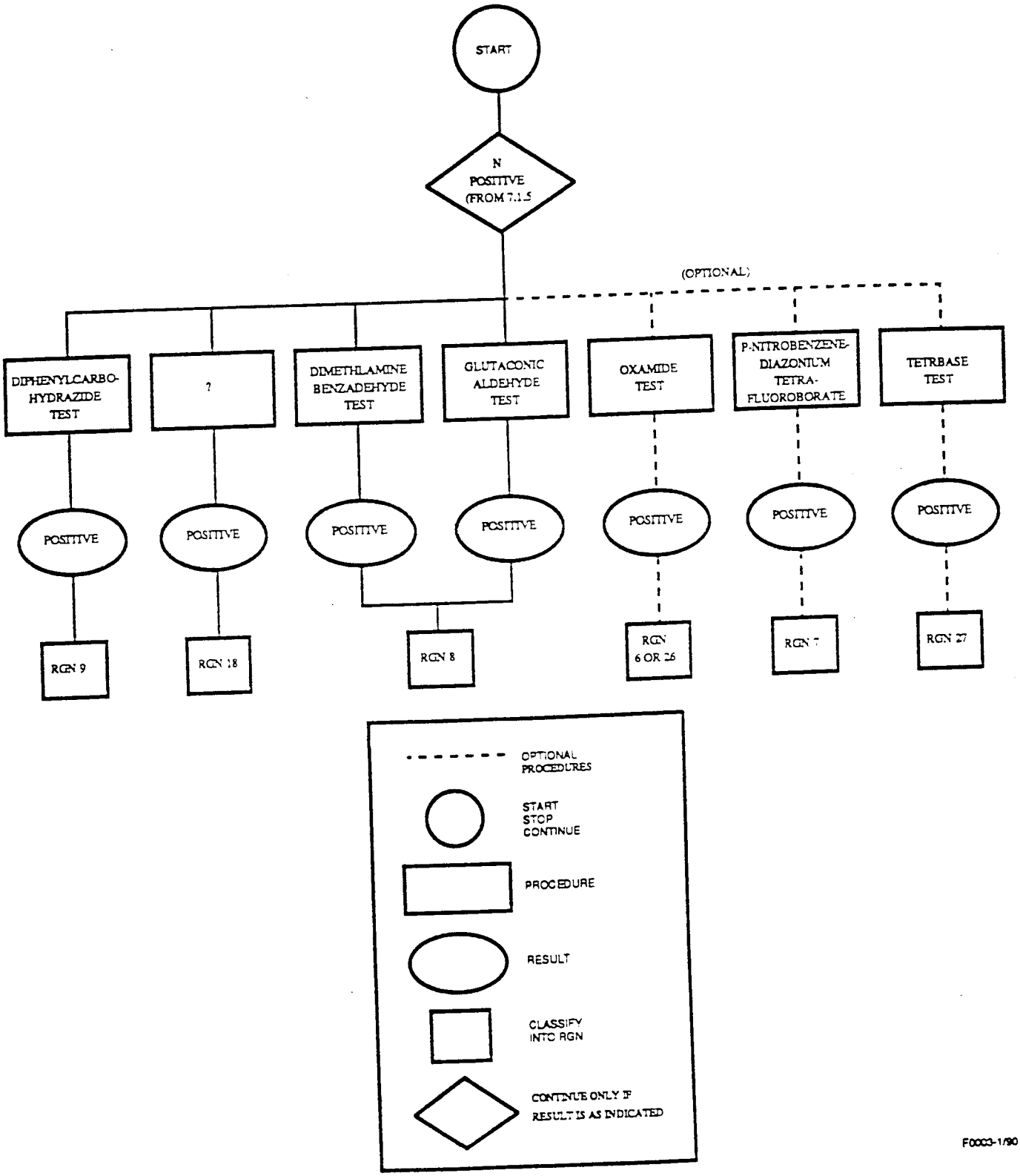

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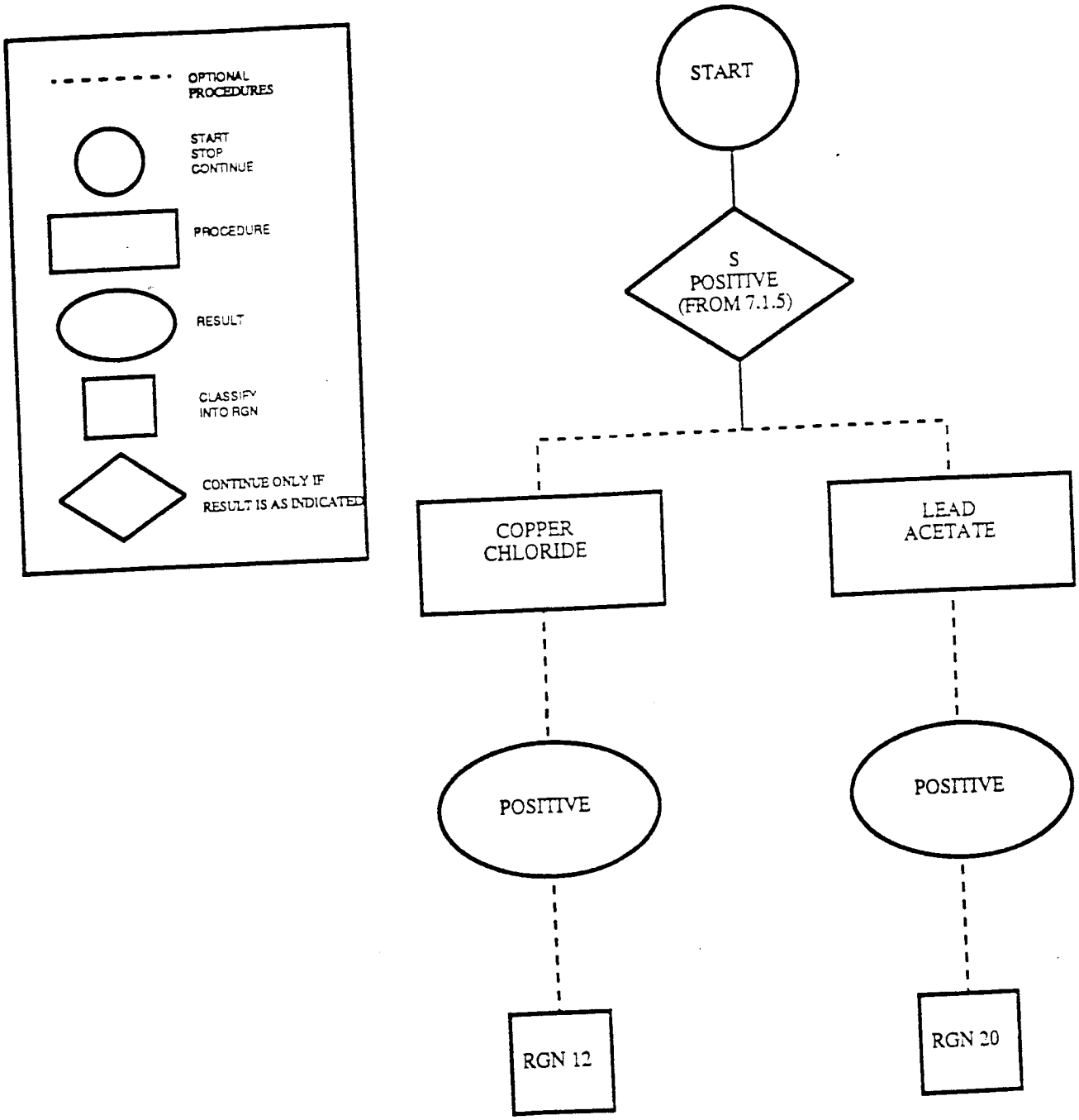
FIGURE 4-9

SULFUR-CONTAINING ORGANIC FUNCTIONAL GROUP TEST FLOW CHART



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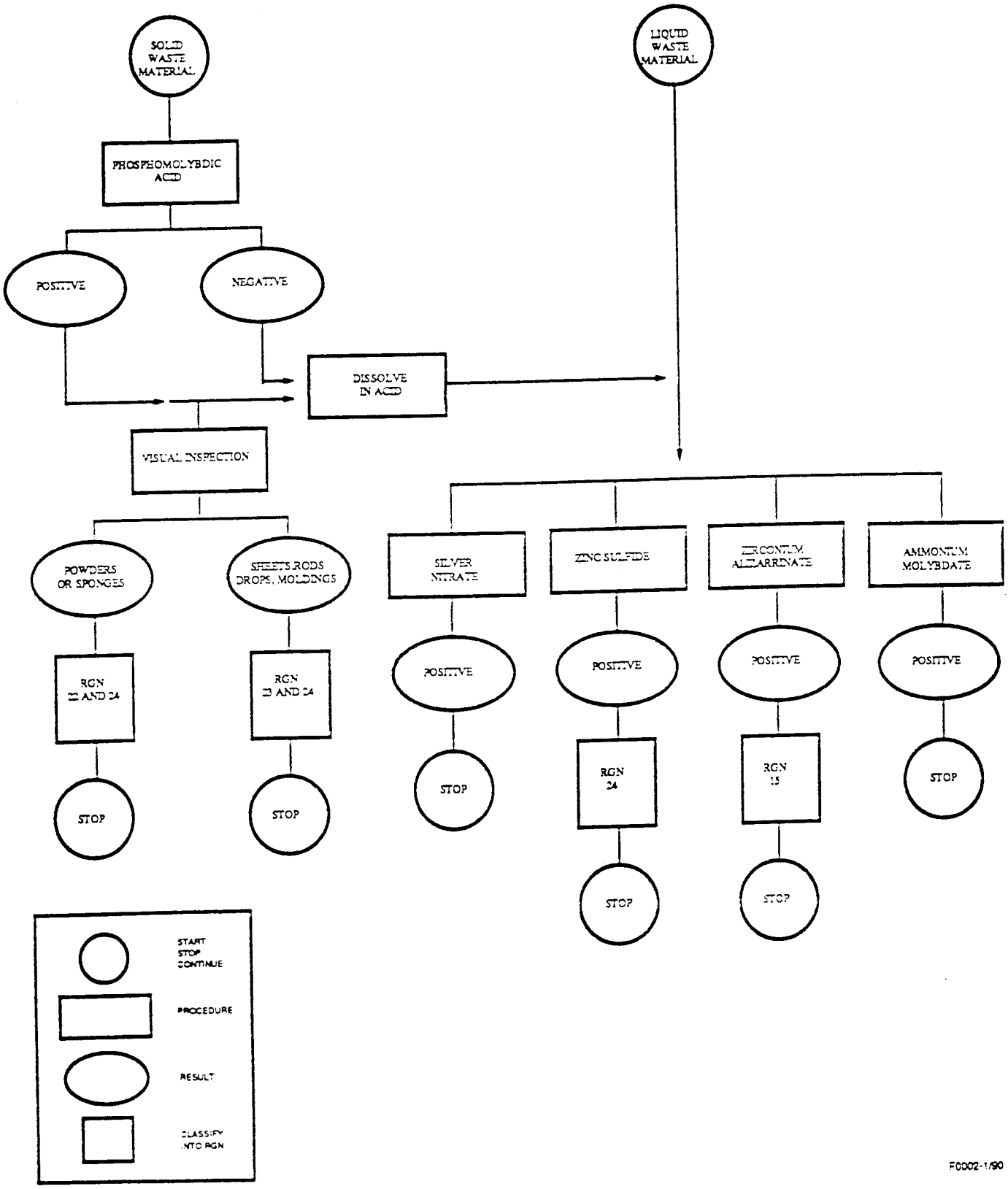
INORGANIC FUNCTIONALITY TEST FLOW CHART

FIGURE 4-10



indicates activity in excess of natural background, no further actions are required. If the GM survey indicates only natural background, then a representative portion of the waste will be analyzed utilizing the GeLi detector in the WSSRAP laboratory as detailed in procedure ES&H 2.6.9s.

4.1.10 Visual Examination

Visual examination of waste materials will aid in consolidation and provide insight into the appropriateness of field or laboratory analysis.

4.1.11 Polychlorinated Biphenyls (PCBs)

This procedure works on the principle of chloride determination. PCBs, which contain chlorine, can be detected by this test; however, any other organic chlorine-containing compound will also be detected by this test and may cause a false positive result. All waste materials that yield a positive result shall be confirmed by a detailed laboratory analysis.

4.1.12 Flash Point

The flash point is necessary to determine regulatory classifications of organic liquids and to ensure safe handling and storage of flammable or ignitable materials.

4.1.13 Field Compatibility Determination

All materials will be verified to be compatible prior to consolidation to ensure employee safety and verity field analytical data. Prior to any consolidation, small representative portions of waste materials will be combined as indicated in Procedure RC-26s.

4.2 Laboratory Analyses

Quantitative analysis is performed in the laboratory to identify hazardous components present in wastes. The presence of listed substances must be determined to allow proper management of WSSRAP wastes.

Chemical analysis data will assist in the development of treatment and/or disposal options, development of burn plans for incinerable wastes, providing data requested by disposal facilities, and confirmation of field analysis data.

The analytical regime specified in this section is comprehensive and should be adequate to provide the information required. Should other preferable technologies evolve in the near future, they will be taken into consideration. Figure 4-11 details the decision process for determining appropriate analytical testing for organic materials and Figure 4-12 details the decision process of aqueous liquids and inorganic solids. The process of determining appropriate analytical testing is complex and requires a great deal of judgement on the part of the Waste Management Group. No strict analytical regime can be prescribed for any given classification but must be evaluated for each waste on a case-by-case basis.

4.2.1 Suspended Solids

Suspended solids can affect the handling and pumping characteristics of the waste during treatment and their measurement is used as a fundamental indicator of the suitability of the waste for various treatment or disposal options.

4.2.2 Total Metals

This analysis meets the requirements to identify hazardous metal constituents identified in Appendix VIII to 40 CFR 261 which is a prerequisite to treatment, storage and disposal facility (TSDF) acceptance for final treatment or disposal. TSDF Part B permits also specify limits on the level of heavy metals in the waste that the incinerator can accept to ensure that a release of toxic metals to the environment does not occur during incineration. Concentrations of total metals may also indicate the potential of a waste to be characteristically hazardous by the toxic characteristic leaching procedure (TCLP).

4.2.3 Volatile Organic Analysis by Gas Chromatography/Mass Spectroscopy (GCMS)

This analysis is designed to identify and quantify volatile organic analytes which appear on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Hazardous Substance List (40 CFR Part 302.4 Table 302.4) of which the Appendix VIII substances are a subset. This data is also used to determine whether those wastes proposed for

FIGURE 4-11

ORGANIC WASTE ANALYTICAL DECISION PROCESS

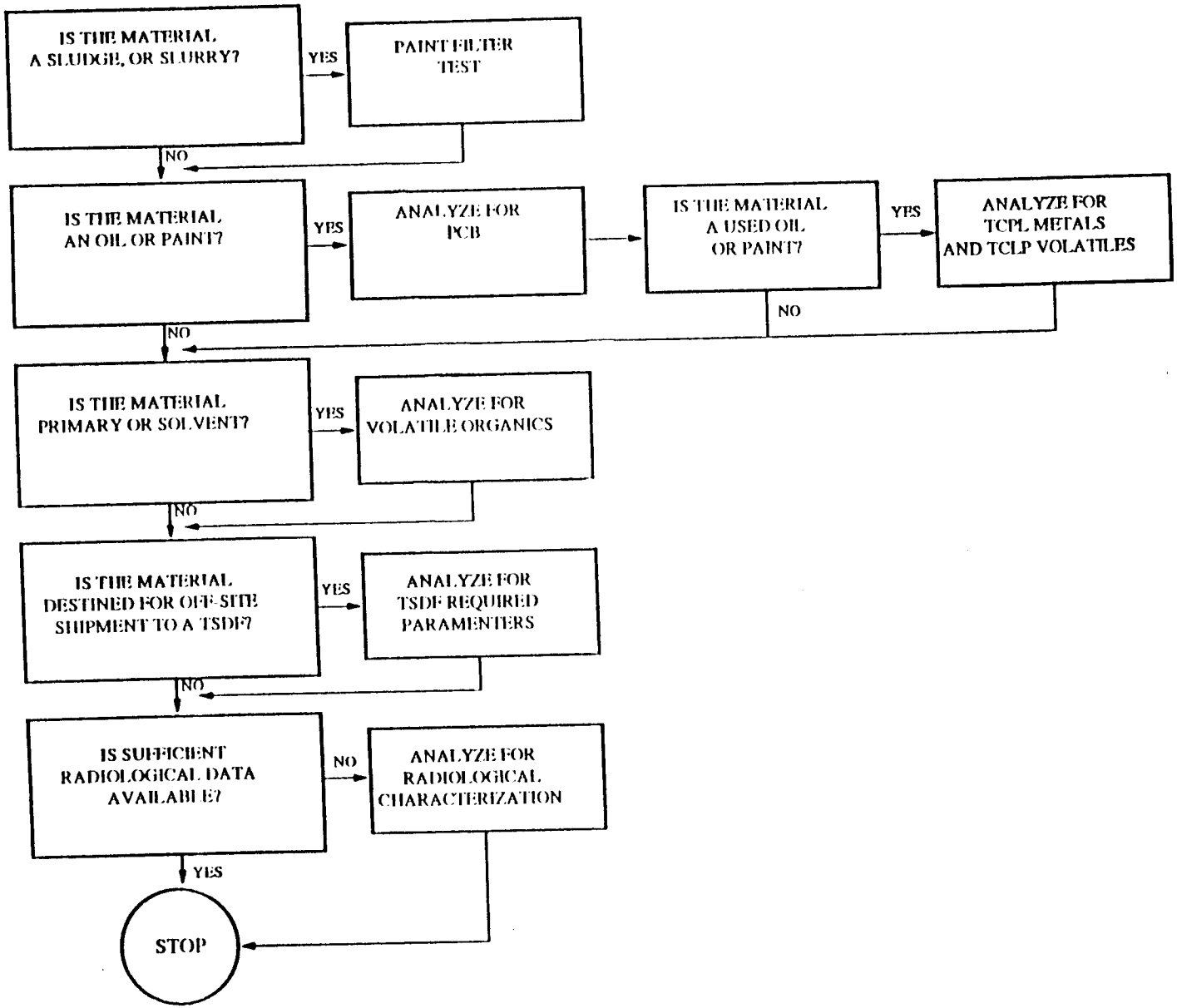


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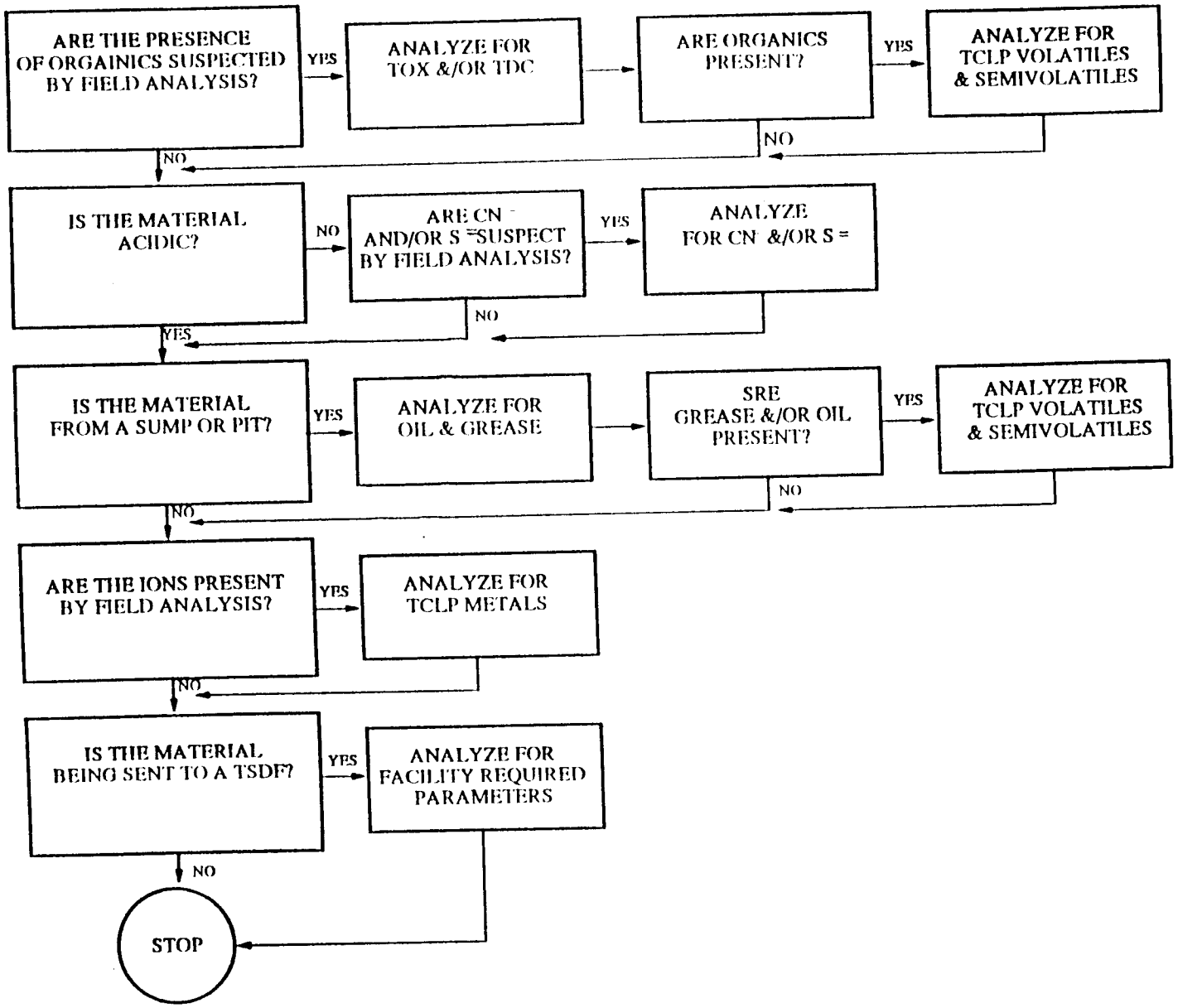
FIGURE 4-12

INORGANIC WASTE ANALYTICAL DESIGN PROCESS



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incineration can be destroyed by the incineration process. This analysis can also be used to detect compounds that may cause the waste to be characteristically hazardous by TCLP and therefore require further analyses by TCLP.

4.2.4 Semi-Volatile Organic Analysis by Gas Chromatography/Mass Spectroscopy (GCMS)

An analysis for these compounds satisfies permit and regulatory requirements to identify organic components which appear on the Appendix VIII list in 40 CFR 261.

4.2.5 Moisture Content

Water content can be used to determine storage compatibility and handling requirements and to provide data for material balance calculations.

4.2.6 Specific Gravity

The specific gravity value is important in calculating material balance across a treatment process and to give a true value of the amount of materials being handled.

4.2.7 Ash Content

This information is important for evaluating wastes for potential slag and ash formation, to assess particulate loading, and to verify that the slag and ash handling system is adequate.

4.2.8 Heating Value

This data is used in determining the acceptability of a waste for incineration, and to ensure that the incinerator heat load is maintained at the proper operating range.

4.2.9 Corrosivity

A material's corrosivity to steel indicates the appropriate type of container to use to avoid incompatibilities and container failures and to dictate regulatory classification.

4.2.10 Elemental Analysis (Carbon, Nitrogen, Sulfur, Phosphorus, Fluorine, Chlorine, Bromine, and Iodine)

Knowledge of these parameters is necessary for determination of incinerator system conditions, computation of stoichiometric air requirements, and to ensure adequacy of pollution control equipment.

4.2.11 Reactivity (Cyanide or Sulfide)

The presence or absence of cyanide and sulfide must be known to assure safe handling and storage, and to determine if treatment to destroy or stabilize these compounds is warranted. Analysis of low pH (≤ 2) materials is unnecessary since, as a rule, materials with an acidic pH will have reacted and liberated any HCN and H^2S present and will not contain cyanide or sulfide.

4.2.12 Toxicity Characteristic Leaching Procedure (TCLP)

TCLP should be performed on all wastes and the solid created after stabilization of liquids and unknown wastes, if it is necessary to determine if the material meets the regulatory definitions of a characteristic waste or the requirements for land disposal in 40 CFR Part 268.

4.2.13 Total Organic Halide (TOX)

The data from this analysis can be used to screen aqueous wastes that may contain levels of halogenated organic contaminants that may not be detectable during field analysis and may need further organic constituent analysis.

4.2.14 Total Organic Carbon (TOC)

This procedure is used to screen aqueous wastes for low level organic contamination that may not have been detected during field analysis. It will also be used to determine if a more specific analysis for organic species may be required.

4.2.15 Paint Filter Test

This will provide information regarding the amount of free liquids that are present in the waste. This information can be used for insuring proper storage and secondary containment.

4.2.16 Radiological Characteristics

Knowledge of the concentration of uranium, thorium, and other appropriate radioactive isotopes is necessary to assure that the limits specified in any specific TSDF Part B or National Emissions Standards for Hazardous Air Pollutants (NESHAP) permit are not exceeded. This information is also for safe handling and storage.

4.2.17 Viscosity

Knowledge of the viscosity of a waste material will allow determination of the type of pump required to handle the waste as well as the need for blending the waste to achieve a more pumpable mixture.

4.2.18 Polychlorinated Biphenyls (PCBs)

The analysis will verify the presence or absence of PCBs and provide insight to the applicability of TSCA regulations to the management of the waste material.

4.2.19 Oil, Grease and Total Petroleum Hydrocarbons (TPH)

This analysis will be limited primarily to samples obtained from sumps and underground storage tanks and will be used to identify treatment or disposal options and to verify that cleanup and/or removal criteria are met.

4.2.20 Dioxin

Dioxin analyses will be performed on those wastes, such as wood, suspected of being treated with chemicals that may have been contaminated with dioxin. The presence of dioxin in a waste will greatly influence the disposal options available.

4.2.21 Asbestos

For materials suspected of asbestos contamination, knowledge of the asbestos content and asbestos type is required to ensure that the material is properly containerized and labeled in accordance with regulatory requirements.

4.2.22 Polyaromatic Hydrocarbons

An analysis for these compounds satisfies regulatory requirements to identify specific organic components that appear on the Appendix VIII list.

4.2.23 Nitroaromatics

Analysis for nitroaromatics will indicate the presence of potentially explosive compounds in soils or wastes that may have been contaminated as result of Weldon Spring Ordnance Works activities. Knowledge of the level of these contaminants is necessary to determine if cleanup criteria for the materials apply or have been met.

4.3 Recharacterization

Recharacterization of site generated wastes is required to verify that the concentration of constituents has not changed significantly, new constituents have not been added, or that the physical properties have not changed. Since the WSS is an inactive facility, recharacterization will not be required for the majority of wastes managed at this project. Wastes generated by site activities, such as field and radiological laboratory waste, will receive full characterization prior to placement into Building 434 for storage.

Other wastes such as purge and development water are generated from wells and areas where sufficient analytical data are maintained from required monitoring activities. Therefore, recharacterization can be evaluated based on data available from the previous quarter.

4.3.1 Fingerprint Screening

Fingerprint screening consists of selected tests that can be performed at the WSS to verify that the gross chemical composition of the waste has not changed significantly. For aqueous and

inorganic wastes, these tests consist of pH, screening for oxidation potential, cyanide, sulfide, and metal ions. Organic materials are tested for the presence of water, sodium fusion, appropriate functional group, and flash point for liquids. The appropriate tests will be run on randomly selected drums of wastes stored in Building 434.

5 SAMPLE MANAGEMENT

Sample management begins as soon as the sample is collected and continues during the transportation to the laboratory, through the analytical phase, and culminates with the return of the sample to the Weldon Spring site (WSS).

As discussed previously, waste samples are collected in accordance with procedure RC-24s. Chain of custody is initiated at this time and documented in accordance with procedure ES&H 4.1.2a. Chain of custody is maintained throughout the packaging phase and custody is transferred to the analytical laboratory to allow for completion of the requested analyses.

All waste management samples must be assigned a unique identifier as follows:

WM-AAAA-BBBBBB-DDD

where

"WM" denotes that this sample is a waste sample taken for characterization purposes.

"AAAA" represents a four digit code denoting the sample location or original container identification.

For containerized wastes that have been assigned waste inventory tracking system (WITS) identification numbers, AAAA must be that number.

For bulk waste samples or containerized wastes that have not been assigned a WITS identification number, the following shall apply to the AAAA designation:

AAAA - PSXX for process sewer samples.
- SUXX for sump samples.
- SXXX for soil samples.
- HXXX for water samples.
- LXXX for oil samples.
- WXXX for swipe samples.
- CXXX for concrete samples.

- WDXX for wood samples.
- SSXX for sanitary sewer samples.
- UKXX for all other samples.

"BBBBBB" represents a six-digit number indicating the sample date (month/day/year).

"DDD" represents a letter denoting quality control status and is not required for all samples.

FD - field duplicate.
MS - matrix spike.
MSD - matrix spike duplicate.
TB - trip blank.
EB - equipment blank.
WB - distilled water blank.

The characteristics of the sample determine the packaging of samples for shipment to off-site laboratories. The *Site Consolidated Transportation Activity Manual* (SCTA) (MKF and JEG 1992c) provides guidance on the proper classification, packaging, labeling, and marking of samples.

The Site Shipping Officer (SSO) administers the shipping program and provides guidance and training to all Project Management Contractor (PMC) or Subcontractor personnel. The SSO also inspects sample shipments for compliance with site procedures and government regulations as well as upon return from off-site laboratories.

Samples returned from off-site laboratories are archived or disposed of in accordance with RC-22a.

6 WASTE CLASSIFICATION

The U.S. Environmental Protection Agency (EPA) identifies a hazardous waste as meeting the criteria shown in two sections in Part 261, 40 CFR. Subpart C outlines the waste's characteristic ignitability, corrosivity, reactivity, and toxic characteristic leaching procedure (TCLP) toxicity, and Subpart D specifically lists hazardous wastes by source or name.

Once a waste material is identified and characterized and found to be a hazardous waste, that hazardous waste must be correlated with a Department of Transportation (DOT) hazard class. A hazardous waste meeting the definition of more than one DOT hazard class shall be classed according to the DOT Hazard Precedence List (49 CFR 173.2).

Any waste material found to have a polychlorinated biphenyl (PCB) concentration greater than 50 ppm is regulated by the Toxic Substances Control Act (TSCA) and must be marked as required by 40 CFR 761 Subpart M.

Any waste material found to have uranium concentrations greater than background by a standard Geiger-Müller (G-M) counter shall be considered radioactive and labeled as such until detailed radiological characterization is completed. Once detailed radiological data are available, the material will be classified as defined by the Department of Transportation in 49 CFR Section 172.

7 RECORDKEEPING

In keeping with the intentions of the reporting and recordkeeping requirements of 40 CFR Part 262, complete documentation of all field and laboratory analyses will be required.

All field sampling and analytical data will be documented on a Weldon Spring Site Remedial Action Project (WSSRAP) Field Analysis Data Sheet.

Off-site laboratory documentation, when requested, will consist of all sample preparation logs, notebook pages, chromatograms (or other instrument printouts) and laboratory custody transfer records.

All field and laboratory data will be maintained on file at the WSSRAP by the Quality Assurance (QA) Department in accordance with QAPP-9 until completion of the project or as directed by the U.S. Department of Energy (DOE) or a minimum of 10 yr after the completion of remedial actions.

All movements of containerized wastes, whether on-site or off-site, will be entered into the Waste Inventory Tracking System (WITS) as detailed in procedure RC-13.

Where appropriate and applicable, photographs will be taken to document field observations. These will be taped to the field data sheet or kept in separate logs intended for this purpose, as necessary.

Data sheets that document methods and equipment used will be maintained during all sampling operations and will be consistent with all WSSRAP standard operating procedures and requirements outlined in SW-846. The required information for these data sheets is detailed in procedure RC-24s.

Data required by the selected treatment or disposal facility for disposal purposes will be made available to the facility in accordance with the facility's requirements. In many instances, this will require completion of a waste profile sheet or similar form required by the chosen facility which details the chemical and physical characteristics of the waste. All such paperwork will be completed by the Waste Management Group and forwarded to the facility with a

representative sample of the waste if required or requested. Copies of any such paperwork will be maintained on file in the Environmental Compliance Departmental files.

8 ACRONYMS

AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry
BADT	best available disposal technology
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLP	Contract Laboratory Program
CRF	Code of Federal Regulations
CWA	Clean Water Act
DNT	dinitrotoluene
DOE	United States Department of Energy
DOT	United States Department of Transportation
DQO	data quality objective
EMSL-LV	Environmental Monitoring and Support Laboratory, Las Vegas
EPA	United States Environmental Protection Agency
EPP	emergency plans and procedures
ES&H	Environmental Safety and Health
FADS	Field Analysis Data Sheet
FUSRAP	Formerly Utilized Sites Remedial Action Program
GCMS	gas chromatography/mass spectroscopy
G-M	Geiger Müller
HCP	Hazard Communication Plan
HEPA	high efficiency particulate air
HSL	Hazardous Substance List
LDR	Land Disposal Restriction
MDNR	Missouri Department of Natural Resources
MSA	material staging area
MSDS	Material Safety Data Sheet
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	United States Nuclear Regulatory Commission

OSHA	Occupational Safety and Health Administration
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyls
PMC	Project Management Contractor
PPE	personal protective equipment
PPERM	Personal Protective Equipment Requirements Manual
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RMMA	radioactive materials management area
RQ	reportable quantity
RSFMP	Remote Surplus Facility Management Program
SARA	Superfund Amendments and Reauthorization Act
SCTA	Site Consolidated Transportation Activity
SDWA	Safe Drinking Water Act
SFMP	Surplus Facility Management Program
SSO	Site Shipping Officer
TCLP	toxic characteristic leaching procedure
TNT	trinitrotoluene
TOC	total organic carbon
TOX	total organic halide
TPH	total petroleum hydrocarbons
TSA	temporary storage area
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
WITS	Waste Inventory Tracking System
WME	Waste Management Engineer
WMG	Waste Management Group
WSCP	Weldon Spring Chemical Plant
WSOW	Weldon Spring Ordnance Works
WSVP	Weldon Spring vicinity property
WSS	Weldon Spring site
WSSRAP	Weldon Spring Site Remedial Action Project
WSQ	Weldon Spring Quarry
WSCP	Weldon Spring Chemical Plant

9 REFERENCES

9.1 Regulations

40 CFR Part 61, Subpart M - *National Emission Standard for Asbestos*

40 CFR Part 261 - *Identification and Listing of Hazardous Wastes*

40 CFR Part 262 - *Standards Applicable to Generators of Hazardous Wastes*

40 CFR Part 264 - *Standards for Operators and Owners of Hazardous Waste Treatment, Storage, and Disposal Units*

40 CFR Part 268 - *Land Disposal Restrictions*

40 CFR Part 302 - *Designation, Reportable Quantities, Notifications*

40 CFR Part 761 - *PCBs Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions*

49 CFR Part 17 2 - *Hazardous Materials Tables and Hazardous Materials Communications Regulations*

49 CFR Part 173 - *Shippers - General Requirements for Shipments and Packaging*

10 CSR 25-11 - *Missouri State Regulations for Waste Oil*

29 CFR Part 1910.1450 - *Occupational Exposure to Hazardous Chemicals in Laboratories*

9.2 Federal Documents

EPA, see U.S. Environmental Protection Agency

U.S. Department of Energy Oak Ridge Gaseous Diffusion Plant, 1986. *Waste Acceptance Plan and Analytical Protocol for the K-1435 Toxic Substance Control Act Incinerator*, Rev. 0. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office. St. Charles, Missouri. October.

U.S. Department of Energy Order 5400.5 - *Radiation Protection of the Public and Environment*

U.S. Environmental Protection Agency SW 846, 1986. *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods. 3rd Edition.*

U.S. Environmental Protection Agency 600/4-79-020, 1981. *Chemical Methods for the Examination of Waters and Wastes*. Cincinnati, Ohio.

U.S. Environmental Protection Agency, 1982. *Resource Conservation and Recovery Act Inspection Manual.*

9.3 Project Management Contractor Plans

MK-Ferguson Company and Jacobs Engineering Group, 1988. *Phase I Chemical Soil Investigation Data Report for the Weldon Spring Chemical Plant/Raffinate Pits*, DOE/OR-21548-016. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office. St. Charles, MO. January.

MK-Ferguson Company and Jacobs Engineering Group, 1989. *Weldon Spring Site Remedial Action Project Safety and Health Manual.*

MK-Ferguson Company and Jacobs Engineering Group, 1991a. *Laboratory Chemical Hygiene Plan*, Rev. 0. DOE/OR/21548-184. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office, Weldon Spring Site Remedial Action Project. St. Charles, MO.

MK-Ferguson and Jacobs Engineering Group, 1991b. *Building Characterization Work Plan*, Rev. 0. DOE/OR/21548-185. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office. St. Charles, Missouri. April.

MK-Ferguson Company and Jacobs Engineering Group, 1991c. *Environmental Quality Assurance Plan*, Rev. 0. DOE/OR/21548-240. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office, Weldon Spring Site Remedial Action Project. St. Charles, MO. November.

MK-Ferguson Company and Jacobs Engineering Group, 1992a. *Waste Management Plan*, Rev. 3. DOE/OR/21548-166. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office. St. Charles, MO. February.

MK-Ferguson Company and Jacobs Engineering Group, 1992b. *Waste Management Training Plan*, Rev. 2. DOE/OR/21548-149. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office. St. Charles, MO. October.

MK-Ferguson Company and Jacobs Engineering Group, 1992c. *Site Consolidated Transportation Activity Manual*, Rev. 0. DOE/OR/21548-309. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office. St. Charles, MO. In press.

9.4 Environmental Compliance Department Procedures

RC-4s	*Field Laboratory Operating Procedure*
RC-9s	*Containerized Waste Labeling Procedure*
RC-13	*Waste Inventory Tracking Procedure*
RC-18a	*Management of Site Generated Waste*
RC-20a	*Container Management Procedure*
RC-21s	*Field Analytical Procedure*
RC-22a	*Management of Samples Returned from Off-site Laboratories*
RC-24s	*Waste Sampling Procedure*
RC-26s	*Field Compatibility Procedure*
RC-31a	*Environmental Monitoring Data Validation*
RC-37s	*Supplemental Analysis Procedure*
RC-38s	*Environmental Compliance Logbook Procedure*

RC-32s *Determining the Radioactive Component of a Hazardous Waste*

9.5 ES&H Department Procedures

ES&H 2.3.8 *Contamination Survey*
ES&H 2.6.3 *GM Detector Calibration, Operation and Usage*
ES&H 2.6.9s *Instructions for Calibration and Operation of the Computer Interface Multi-Channel Analyzer with a High Purity Germanium Detector*
ES&H 4.1.2 *Chain of Custody*
ES&H 4.3.1s *Surface Water Sampling*
ES&H 4.4.5 *Soil and Sediment Sampling*
ES&H 4.9.1 *Environmental Monitoring Data Verification*
ES&H 6.2.1 *Hazardous Waste Site Health and Safety Training*

9.6 Quality Assurance Procedures

QAPP-1 *Quality Assurance Program Plan Organization*
QAPP-9 *Quality Assurance Records*
QAPP-10 *Audits*
SQA-2a *Quality Assurance Surveillance*

9.7 Other

Acurex Corporation, 1984. *Design and Development of a Hazardous Waste Reactivity Testing Protocol*. Mountain View, CA.

Appendix A

TABLE 1 K-1435 Waste Acceptance Plan

TABLE 1 Waste Analysis Parameters and Methods

Parameter	Method	References
Chlorine	1. A004	1. "Sampling and Analysis Methods for Hazardous Waste Incineration," EPA-600/8-84-002, February 1984
	2. EPA-9020	2. "Test Methods for Evaluating Solid Waste," Physical and Chemical Methods; USEPA SW-846, 3rd Edition
	3. ASTM-2361	3. ASTM D-2361-85; "Test Method for Chlorine in Coal"
	4. [a]ASTM-3286/ EPA-300.00	4. ASTM D-3268-84; "Test Method for Gross Calorimetric Value of Coal and Coke by the Isothermal Bomb Calorimeter"/"The Determination of Inorganic Anions in Water by Ion Chromatography," EPA-600/4-84-017, March 1984
Sulfur	1. ASTM-129	1. ASTM D-129-64 (1978); "Test Method for Sulfur in Petroleum Products (General Bomb Method)"
	2. [a]ASTM-3286/ EPA-300.00	2. ASTM D-3286-84; "Test Method for Gross Calorimetric Value of Coal and Coke by the Isothermal Bomb Calorimeter"/"The Determination of Inorganic Anions in Water by Ion Chromatography," EPA-600/4-84-017, March 1984
Phosphorus	1. A021 (ICAP)	1. "Sampling and Analysis Methods for Hazardous Waste Incineration," EPA-600/8-84-002, February 1984.
	2. EPA-6010 (ICAP)	2. "Test Methods for Evaluating Solid Waste," Physical and Chemical Methods; USEPA SW-846, 3rd Edition
Fluorine	1. ASTM-3761	1. ASTM D-3761-84; "Test Method for Total Fluorine on Coal by the Oxygen Bomb Combustion/Ion Selective Electrode Methods"
	2. [a]ASTM-3286/ EPA-300.00	2. ASTM D-3286-84; "Test Method for Gross Calorimetric Value of Coal and Coke by the Isothermal Bomb Calorimeter"/"The Determination of Inorganic Anions in Water by Ion Chromatography," EPA-600/4-84-017, March 1984
Ash (Liquid)	1. A001	1. "Sampling and Analysis Methods for Hazardous Waste Incineration," EPA-600/8-84-002, February 1984
	2. ASTM-482	2. ASTM D-482-80; "Test Method for Ash from Petroleum Products"

TABLE 1 Waste Analysis Parameters and Methods (Continued)

Parameter	Method	References
Ash (Solid)	1. A001	1. "Sampling and Analysis Methods for Hazardous Waste Incineration," EPA-600/8-84-002, February 1984
	2. ASTM-3174	2. ASTM D-3174-82; "Test Method for Ash in the Analysis Sample of Coal and Coke from Coal"
Water	1. ASTM-1533	1. ASTM D-1533-83; "Test Method for Water in Insulating Liquids (Karl Fischer Method)"
	2. ASTM-1064	2. ASTM E-1064-85; "Test Method for Water in Organic Liquids by Colorimetric Karl Fischer Titration"
Cyanide	1. EPA-335.2	1. "Methods for Chemical Analysis of Water and Wastewater," EPA-600/4-79-020, March 1983
PCB	1. EPA-8080	1. "Test Methods for Evaluating Solid Waste," Physical and Chemical Methods, USEPA SW-846 2nd Edition
Uranium (Total)	1. Colorimetric	1. TP-0803; "Colorimetric Uranium," ORGDP Analytical Chemistry Department Technical Procedures Manual
	2. Fluorometric	2. TP-0803; "Fluorometric Uranium," ORGDP Analytical Chemistry Department Technical Procedures Manual
	3. EPA-6010	3. "Test Methods for Evaluating Solid Waste," Physical and Chemical Methods,: USEPA SW-846 3rd Edition
235U Assay	1. Thermal Ionization Mass Spectrometric Method	1. TP-2101; "Thermal Ionization Mass Spectrometric Method," ORGDP Analytical Chemical Department Technical Procedures Manual
Specific Gravity	1. ASTM-3142	1. ASTM D-3142-84; "Test Method for Specific Gravity or API Gravity of Liquid Asphalts by Hydrometer Method"
Viscosity	1. ASTM-445	1. ASTM D-445-83; "Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)"
Flash Point (F)	1. EPA-1010	1. "Test Methods for Evaluating Solid Waste," USEPA SW-846, 2nd Edition

TABLE 1 Waste Analysis Parameters and Methods (Continued)

Parameter	Method	References
Suspended Solids	1. EPA-160.1	1. "Methods for Chemical Analysis of Water and Wastewater," EPA-600/4-79-020, March 1983
Size (wt% >20 mesh)	1. ASTM-310	1. ASTM D-310-69(1989); "Test Method for Size of Anthracite"
pH (Liquid)	1. EPA-9040	1. "Test Methods for Evaluating Solid Waste," Physical and Chemical Methods, USEPA SW-846, 3rd Edition
pH (Organics)	2. EPA-9041	2. "Test Methods for Evaluating Solid Waste," Physical and Chemical Methods, USEPA SW-846, 3rd Edition
pH (Solids)	3. EPA-9045	3. "Test Methods for Evaluating Solid Waste," Physical and Chemical Methods, USEPA SW-846, 3rd Edition
Heating Value Btu/lb	1. ASTM-3286	1. ASTM D-3286-84; "Test Method for Gross Calorific Value of Coal and Coke by the Isothermal Bomb Calorimeter"
	2. ASTM-240	2. ASTM D-240-76(1980); "Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter"
Number of Phases	1. Visually	
Metals by ICP (A1, Be, Cd, Fe, Li, Na, Pb, Cu, Mg, Mn, Ni, Ti, Zn)	1. EPA-6010	1. "Test Methods for Evaluating Solid Waste," Physical and Chemical Methods, USEPA SW-846, 3rd Edition
Metals by AA (As, Se)	1. EPA-7060	1. "Test Methods for Evaluating Solid Waste," Physical and Chemical Methods, USEPA SW-846, 3rd Edition
Mercury by Cold Vapor AA	1. EPA-7470/7471	1. "Test Methods for Evaluating Solid Waste," Physical and Chemical Physical and Chemical Methods, USEPA SW-846, 3rd Edition

TABLE 1 Waste Analysis Parameters and Methods (Continued)

Parameter	Method	References
Technetium-99	1. EC-186	1. EC-186; "Technetium-99 in Water (Radiochemical Method)," Martin Marietta Energy Systems Env. and Effluent Analysis Manual
	2. EC-260	2. EC-260; "Technetium-99 in Air Filters (Radiochemical Method), "Martin Marietta Energy System Env. and Effluent Analysis Manual
	3. EC-355	3. EC-355; "Technetium in Sediment and Soil (Radiochemical Method)" Martin Marietta Energy System Env. and Effluent Analysis Manual
Corrosivity Toward Steel	1. EPA-1110	1. "Test Methods for Evaluating Solid Waste," Physical and Chemical Methods, USEPA SW-846, 2nd Edition
Neptunium	1. TP-1635	1. TP-1635; "Neptunium, Alpha Activity," ORGDP Analytical Chemical Department Technical Procedures Manual
Plutonium	1. TP-1635	1. TP-1635; "Plutonium, Alpha Activity," ORGDP Analytical Chemical Department Technical Procedures Manual
Thorium	1. TP-1635	1. TP-1635; "Thorium, Alpha Activity," ORGDP Analytical Chemical Department Technical Procedures Manual
Cesium	1. EC-134	1. EC-134; "Gamma-Ray Emitting Nuclides (Nondestructive Spectrometric Method)" Martin Marietta Energy Systems Env. and Effluent Analysis Manual
Tritium	1. EC-189	1. EC-189; "Tritium in Water" (Radiochemical Method) Martin Marietta Energy Systems Env. and Effluent Analysis Manual
Alpha/Beta	1. EPA-900	1. EPA-600/4-80-32; August 1980 "Prescribed Procedure for Measurement of Radioactivity in Drinking Water"
Gamma Activity	1. EC-134	1. EC-134; "Gamma-Ray Emitting Nuclides (Nondestructive Spectrometric Method)" Martin Marietta Energy Systems Env. and Effluent Analysis Manual

a ASTM-2361, ASTM-3286, ASTM-3761, and ASTM-129 all use the bomb calorimeter for sample preparation. Therefore, the solution obtained in ASTM-3286 to determine the heating value can also be used with EPA Method 300.00, "The Determination of Inorganic Anions in Water by Ion Chromatography," to determine chlorine, sulfur, and fluorine.